# AUTOMOTIVE INDUSTRIES

AUTOMOTIVE and AVIATION MANUFACTURING
ENGINEERING • PRODUCTION • MANAGEMENT

DECEMBER 15, 1956

*In This Issue*

Automatic Assembly Line in Mechanized Battery Plant
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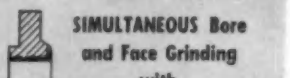
A CHILTON PUBLICATION

# 8 Ways to COMBINE

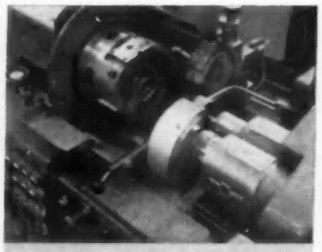
## BORE and FACE GRINDING OPERATIONS

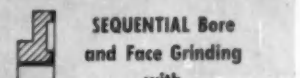
### with Heald Multi-Spindle Internals



**SIMULTANEOUS Bore and Face Grinding with SLIDE-BAR FACING**

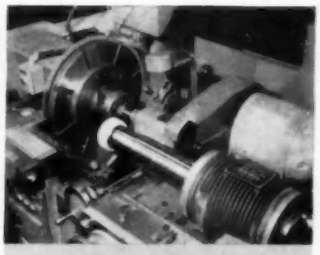
Bore grinding wheel reciprocates with table while facing wheel, mounted on anti-friction slide bars, is held forward against work under spring pressure. Face feeding stop controls depth of face grind.

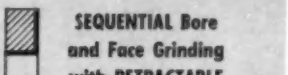




**SEQUENTIAL Bore and Face Grinding with MANUAL FACING**

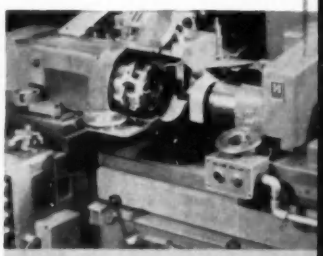
Face is first plunged with manual facing attachment, while bore wheel enters bore without contacting work. Bore is then ground in Size-Matic cycle (facing wheel positioned to clear work on instroke).

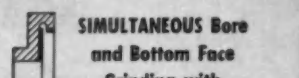




**SEQUENTIAL Bore and Face Grinding with RETRACTABLE FACING HEAD**

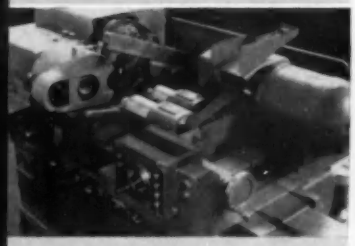
With motorized facing wheelhead in extended position, face is plunge ground with manual feed (bore wheel is clear of work). Workhead is indexed forward and bore ground in Size-Matic cycle.

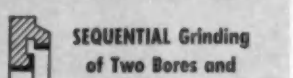




**SIMULTANEOUS Bore and Bottom Face Grinding with SINGLE WHEELHEAD**

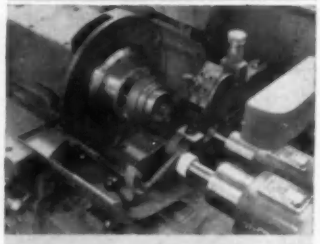
Combined bore and facing wheel feeds against work while workhead feed is operating, grinding face to finish size and plunging bore to semi-finish size. Wheel plunges bore to finish size while held clear of face.

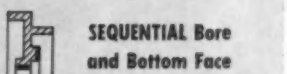




**SEQUENTIAL Grinding of Two Bores and Bottom Face with SPACED WHEELHEADS**

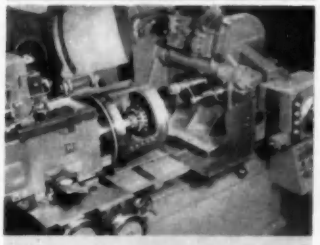
Small bore first ground to size (second wheel clears work), then workpiece is indexed forward in front of second wheel. Large bore is plunge ground and at same time wheel is fed forward to face grind bottom face.

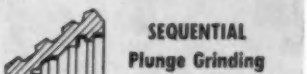




**SEQUENTIAL Bore and Bottom Face Grinding with SPACED WHEELHEADS**

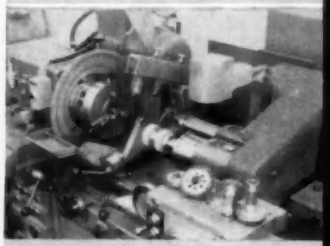
With workhead in rear position, bore is ground in Size-Matic cycle (facing wheel spaced to clear work). Work is then indexed forward and face is plunge ground to finish size, (bore wheel clears work).

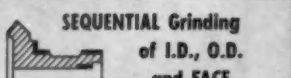




**SEQUENTIAL Plunge Grinding of STRAIGHT AND CONTOUR BORES**

Two wheelheads first plunge grind large straight bore and spherical ball race. Work is then indexed forward and small combined straight and taper bores are plunged with shaped wheel.





**SEQUENTIAL Grinding of I.D., O.D. and FACE with Spaced Wheelheads**

Bore is first ground to finish size with workhead in rear position (face and O.D. wheels clear of work). Workhead indexes forward and bottom face and two O.D.'s are plunge ground with double wheel.

WHENEVER two or more grinding operations can be done at a single chucking, you convert handling time into *grinding time*. What's more, you get a more positive relationship between ground surfaces than could be obtained by any other method. Here are eight different Heald setups for performing such combined operations quickly and economically. For complete information, send for a copy of new Bulletin No. 2–69–2.

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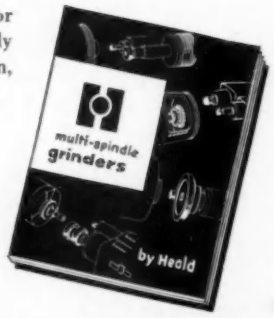


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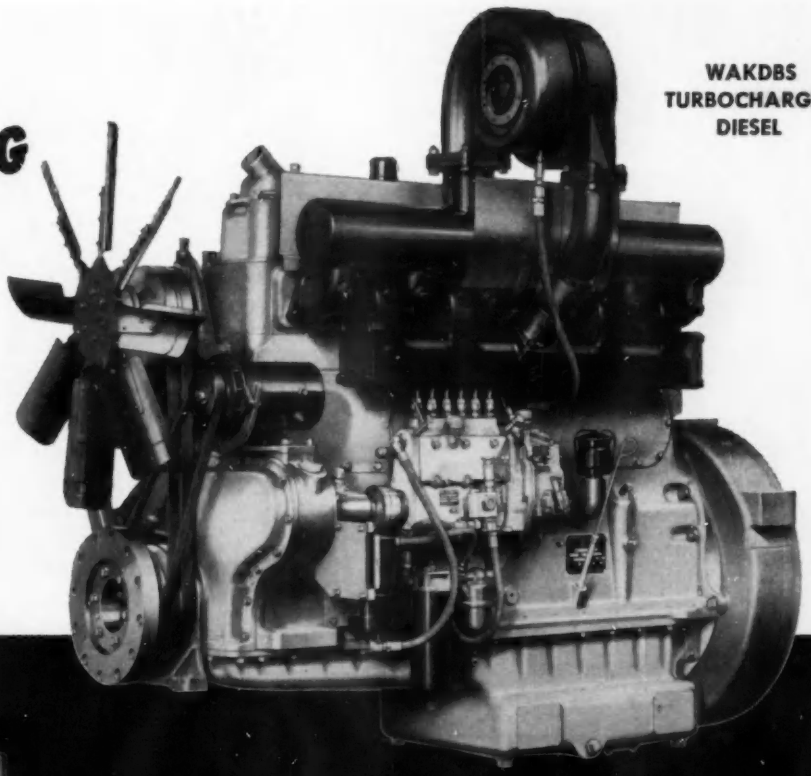
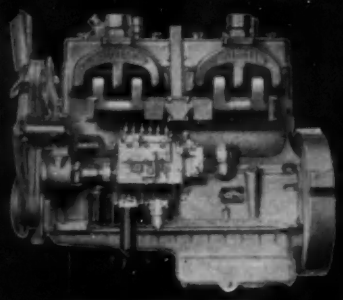
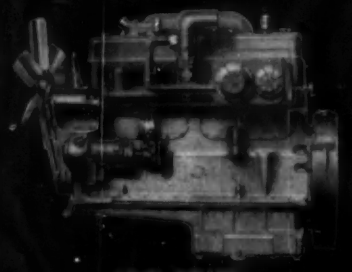


WAKDBS TURBOCHARGED DIESEL



WAKDB NORMAL DIESEL



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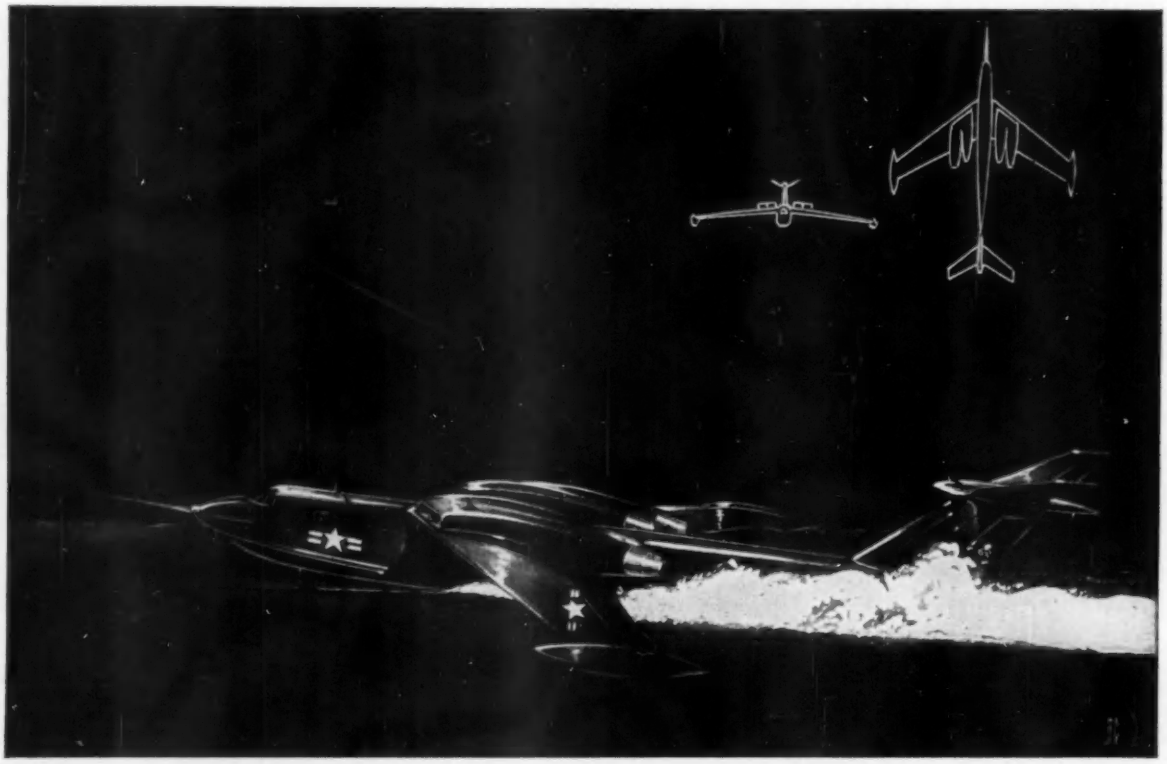

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# AUTOMOTIVE INDUSTRIES

A CHILTON MAGAZINE — PUBLISHED SEMI-MONTHLY

DECEMBER 15, 1956 — VOL. 115, NO. 12


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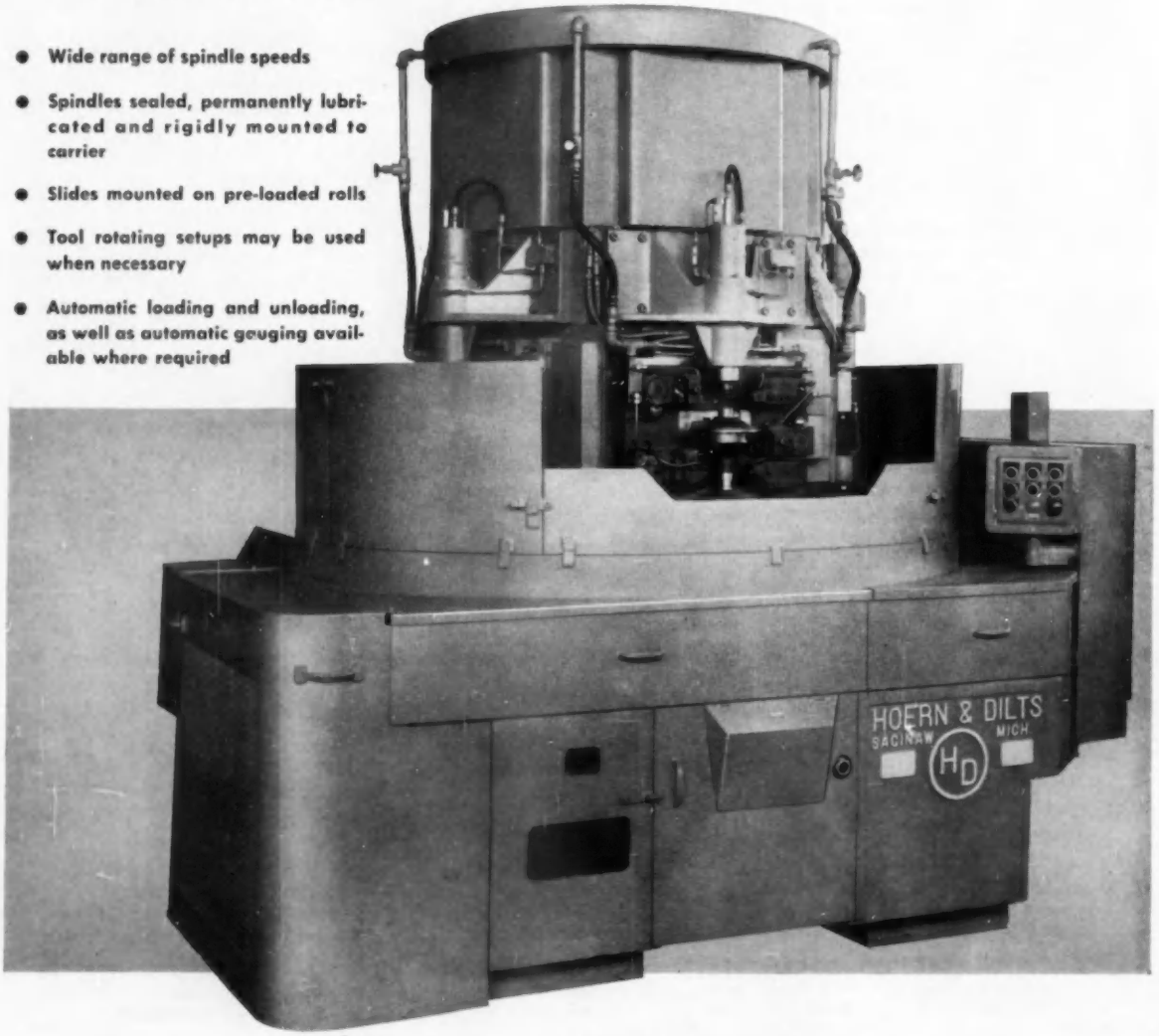


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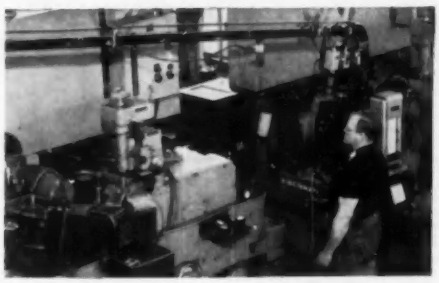

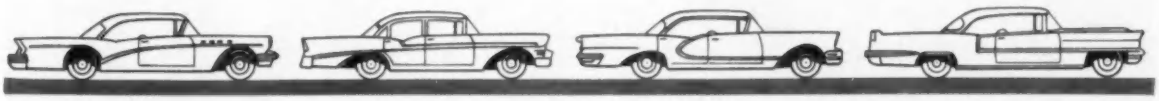

# When you think of taper roller bearings think of HYATT

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**HYATT HY-ROLL BEARINGS FOR CARS AND TRUCKS**

Paul Richard (right) discussing compression-ratio trends with automotive engineers.

# PAUL RICHARD . . . a new kind of industry representative

Paul Richard's job is an unusual one. He belongs to a new breed of "scientific ambassadors" who help coordinate the work and ideas of two major industries whose products work together at the consumer level—in this case, the petroleum and automotive industries.

By training and profession, Paul is an automotive fuel specialist. He is a member of the Du Pont Petroleum Chemicals Division's technical staff.

He joined Du Pont in 1949, and until 1953 did engine research work on fuels. His experience includes a great deal more than just passenger-car fuels. During World War II, he was with the National Advisory Committee for Aeronautics, where he worked on fuel evaluation, cooling, compound power plants, and turbo-jet fuel systems. Later, with the Lima-Hamilton Corporation, he worked on locomotive diesel engines and free-piston gas turbine power plants.

One of Paul's most important jobs today is keeping posted on the new engineering developments in the auto industry, especially those which affect the performance of fuels and lubricants. With this information, Paul and his associates at Du Pont are better able to forecast the chemical additive requirements of refiners, and can be of more help to them on their technical problems involving the use of additives.

Swapping ideas on such subjects is of benefit to both the petroleum and automotive industries. In fact, this sort of free exchange of technical ideas has probably contributed materially to the progress of American industry as a whole.

If you have any problems where swapping ideas with any of our technically trained men might be of help, just let us know.

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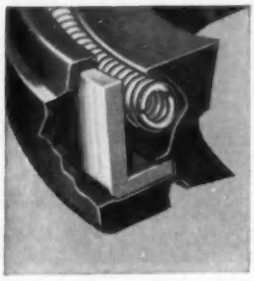

**Type K4 with Victoprene on O.D.**

For installations requiring sealing element on outer periphery and outside face, K4 seals are so designed. Otherwise, construction is identical with K6 seal as above.

The K6 offers you highly developed double lip design with integral metal O.D. case and supplementary edge sealing. Thoroughly proven on heavy-duty applications, this construction is the modern replacement for costlier compound element seals and multiple seal installations.

The K6's efficient dual function of sealing in lubricant and sealing out foreign matter permits maximum compactness in seal housing.

The sealing element is oil-, age- and heat-resisting Victoprene synthetic rubber. Exclusive Victor process of mechanical and chemical bonding combines the element and metal case into a permanent single-unit structure.

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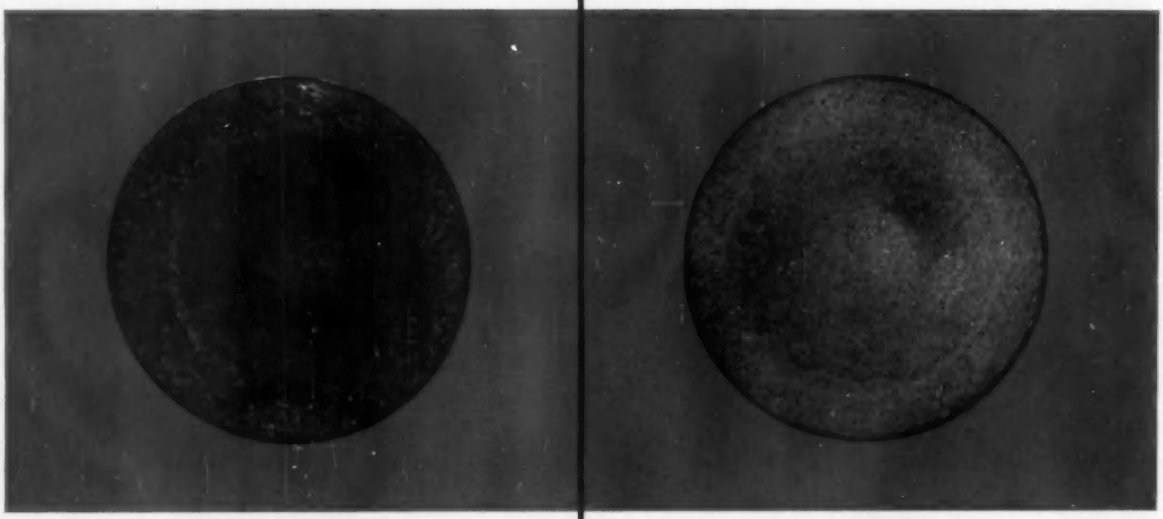
# The EATON Process of Aluminizing Exhaust Valve Heads PREVENTS PRE-IGNITION

*CAUSED BY INCANDESCENT SCALE*



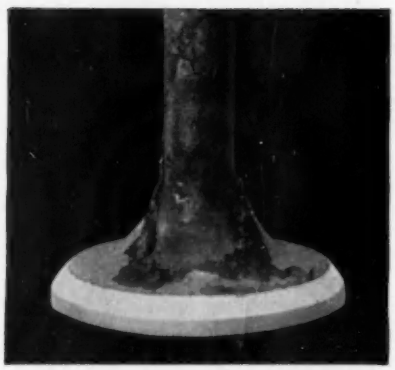
**NOT ALUMINIZED**
Note Scale which Promotes Pre-ignition

**ALUMINIZED**
Absence of Harmful Scale Prevents Pre-ignition

**Conventional exhaust valve steels, run at high temperatures, tend to corrode and scale, promoting damaging pre-ignition. This condition can be overcome by the use of expensive high-alloy materials. However, there is a simple and less expensive solution to the problem. By applying the Eaton aluminizing process to conventional exhaust valve steel, resistance to corrosion and scaling can be increased tremendously, thereby eliminating a condition which can be a major cause of pre-ignition.**

**Inlet valves conditioned by the Eaton aluminizing process also are contributing to the increased efficiency, dependability and service life of engines.**

**Our Valve Division engineers will be glad to discuss the application of Eaton aluminized valves to your engines. Send for illustrated literature.**

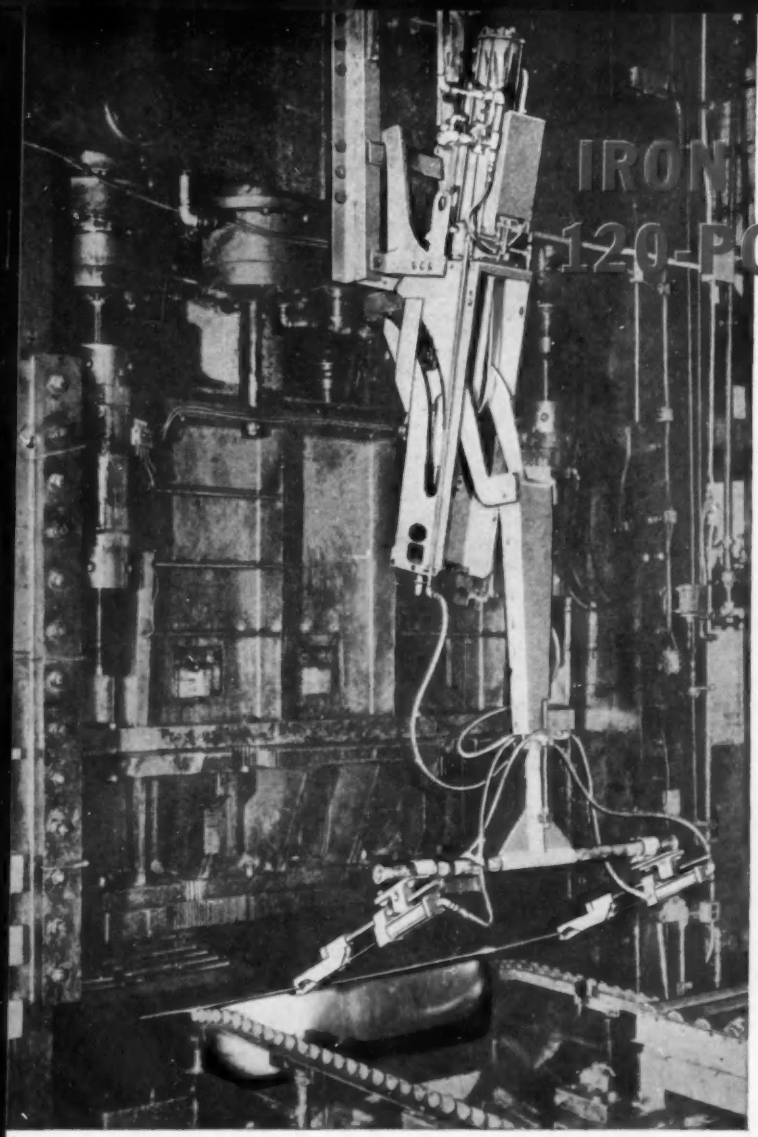


**Aluminizing of Inlet Valve Seat-Face Prevents Oxidation**

After aluminizing by the Eaton process, this plain carbon steel valve was placed in an air atmosphere furnace at 2000°F. for 16 hours. Gross oxidation of the base steel resulted. The aluminized seat-face and margin areas were unaffected.

**EATON** *VALVE DIVISION*
**MANUFACTURING COMPANY**
**9771 FRENCH ROAD • DETROIT 13, MICHIGAN**

**PRODUCTS:** Engine Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Hydraulic Pumps Motor Truck Axles • Permanent Mold Gray Iron Castings • Forgings • Heater-Defroster Units • Automotive Air Conditioning Fastening Devices • Cold Drawn Steel • Stampings • Gears • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers



# IRON HAND UNLOADS 120-POUND BATHTUBS

## ...at Kaiser Metal Products

As fast as this 1800-ton press can deep draw these 120-pound bathtubs, the Iron Hand moves in, raises the tub, and swings it out onto a conveyor.

As a result of this installation at the Bristol (Pa.) plant, Kaiser Metal Products, Inc., was able to—

**speed up production** by utilizing full-rated press capacity

**increase safety** by transferring two men to another line

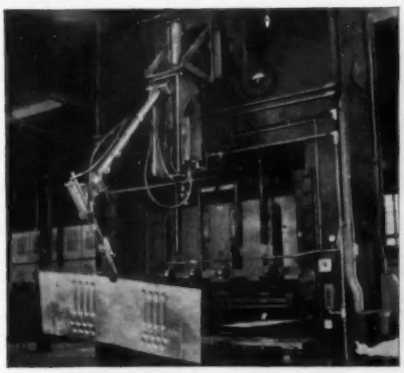
**cut costs** through greater output and lower labor charges.

Many other companies are finding the Iron Hand a low-cost, efficient production tool for virtually every type of sheet metal unloading. And here's why:

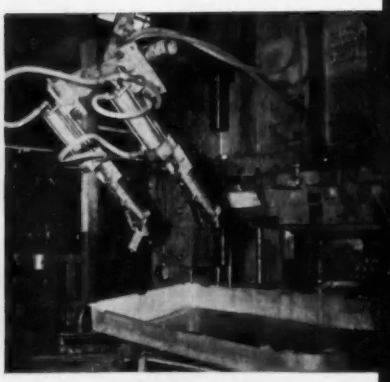
It's designed for fast installation, quick adjustments, and easy movement from press to press. With a wide selection of jaws available, the Hand can be adapted to a variety of stamped shapes.

**Consider this:** In every case a Sahlin Iron Hand brings you greater savings through higher output, increased safety, lower labor charges. You owe it to yourself to find out more about the Iron Hand. Write today for our new catalog.

**BATHTUB BLANKS,** of 14-gage steel, are fed to this 1800-ton double action press and are drawn to 15". Tubs weigh from 115 to 120 pounds, and are more than six feet long overall. Production rate: four to five a minute. Actually, Iron Hands can work at speeds up to 30 strokes per minute on medium size and large stampings. Because of the unusual nature of the blank, this model Iron Hand was specially-designed with double mounted jaw assemblies. Standard Iron Hands, equipped with single jaws, are ordinarily used to unload hoods, roofs, quarter panels and similar large stampings.



**AT HOTPOINT**—One of the many Iron Hands in use here, this one is shown unloading an eight-pound oven liner. Iron Hands unload practically any stamping.



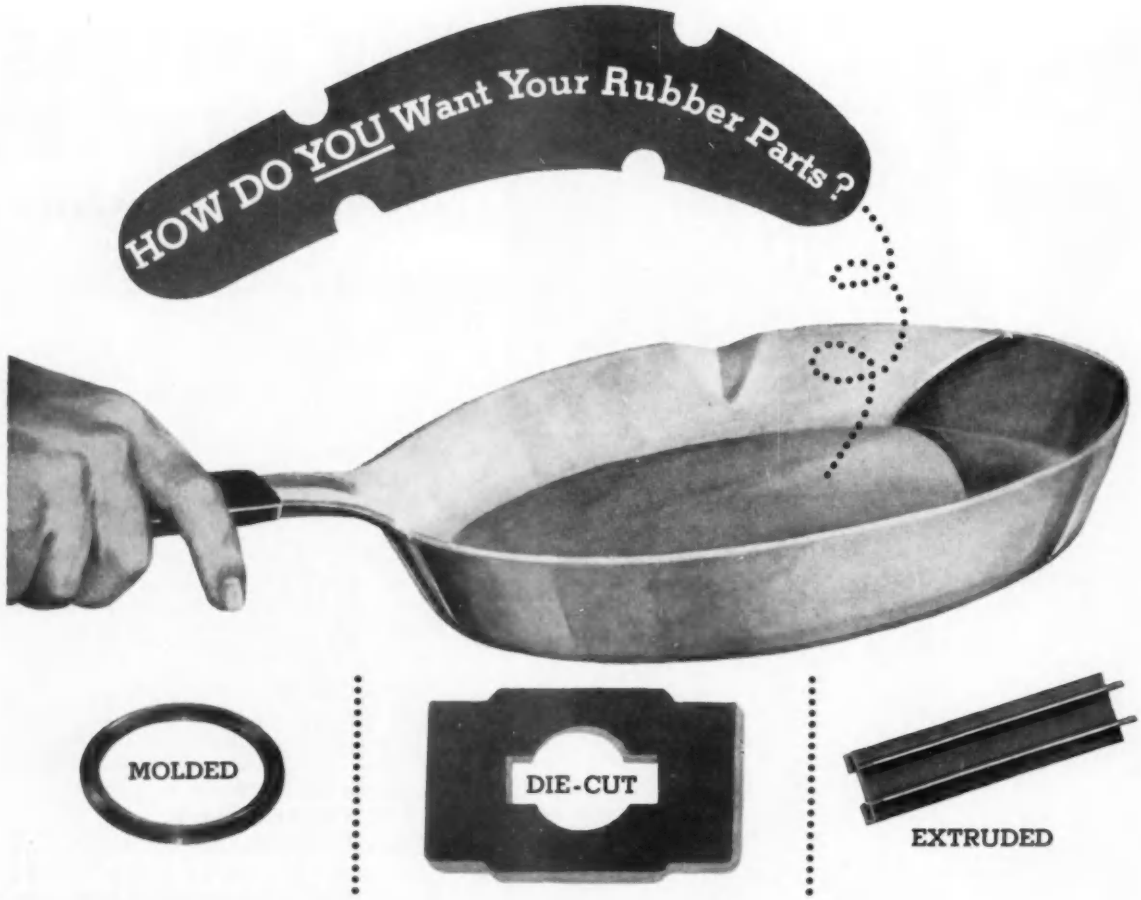
**ON REFRIGERATOR DOORS**—A special Iron Hand is used to whip doors out of the die as fast as the press can make them.

SAHLIN IRON HAND

## SAHLIN ENGINEERING COMPANY, INC.

**P. O. Box 289, Birmingham, Michigan**

OVERHEAD ARMS • FLOOR TYPE UNLOADERS • TURNOVER, TRANSFER AND LOADING MACHINERY




# ACADIA *Has 'em All Three Ways*

Every customer has a right to his synthetic rubber parts the way he wants them.

The more complicated the requirements, the easier for our engineers at Acadia to go to work. Our long experience guides us in giving you exactly the characteristics you desire. We process synthetic components, for oil-resistance, good aging properties, strength, compression-deflection, or any combination you specify.

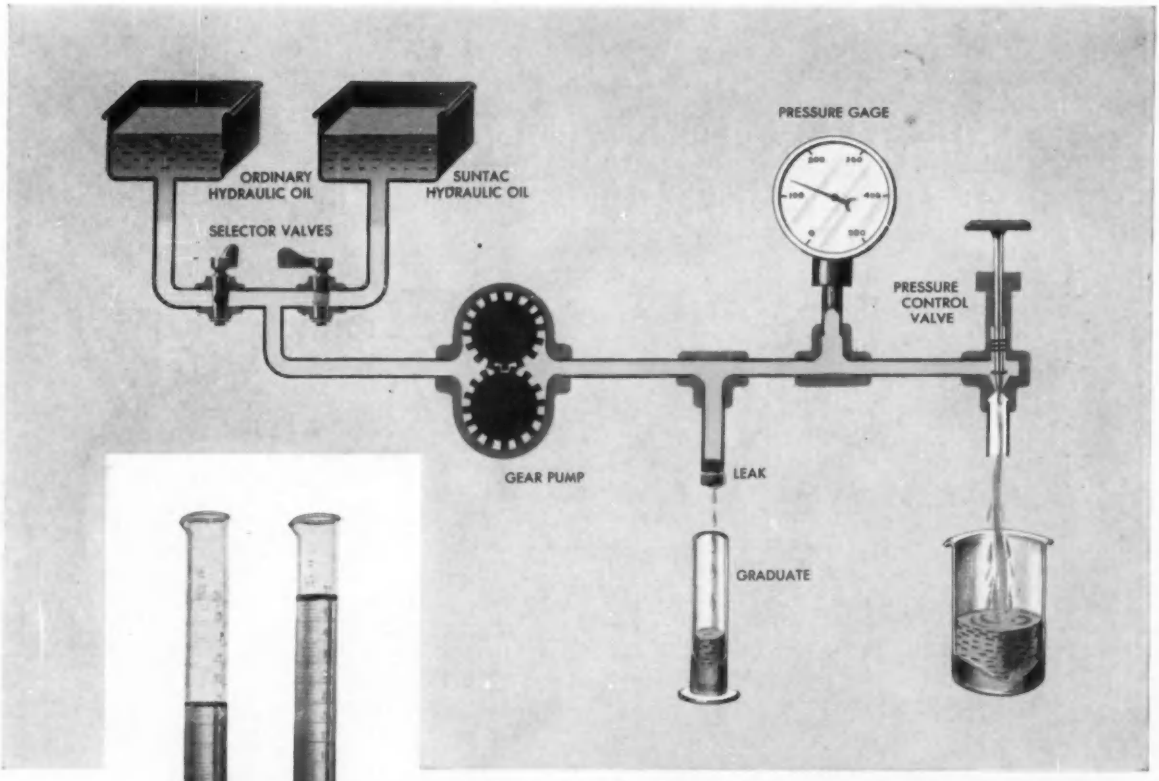
And if you require resistance to heat or cold, remember Acadia SILICONE rubber stays resilient at 100° below zero or 500° above. Silicone is molded or extruded for gaskets, seals, "O" rings, washers, sheets, cut-parts and packings.

There is an Acadia Sales Engineer serving your area. A letter will put him in touch with you immediately.

**ACADIA** *Synthetic* **PRODUCTS**

DIVISION OF WESTERN FELT WORKS
4021-4139 West Ogden Avenue, Chicago 23, Illinois
*Branch Offices in Principal Cities*

MANUFACTURERS AND CUTTERS OF WOOL FELT




The leak rate of ordinary oil vs. Suntac was measured in test machine simulating a typical leak in a hydraulic system. Oil viscosities were equal, time and pressure conditions identical. The simple act of switching from the ordinary oil to Suntac, *without any other changes*, reduced oil leakage by 50%.

# PRESSURE SYSTEM DESIGNED TO LEAK PROVES SUNTAC CUTS OIL LOSSES UP TO 50%

If you're having troubles with excessive oil leakage, a Suntac® oil can help you. Because of their unusual anti-leak characteristics, Suntac oils reduce oil consumption up to 90%, users report.

Suntac oils will not gum up or otherwise harm circulating systems. These oils are high-quality petroleum products with a life expectancy longer than that of ordinary hydraulic and circulating oils.

A change to a Suntac oil can lower your oil costs... improve housekeeping... result in safer working conditions.

Your Sun representative can tell you more about Suntac oils. Or write for Technical Bulletin 23. Address SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AA-12.

SUNOCO

**INDUSTRIAL PRODUCTS DEPARTMENT**

**SUN OIL COMPANY** Philadelphia 3, Pa.

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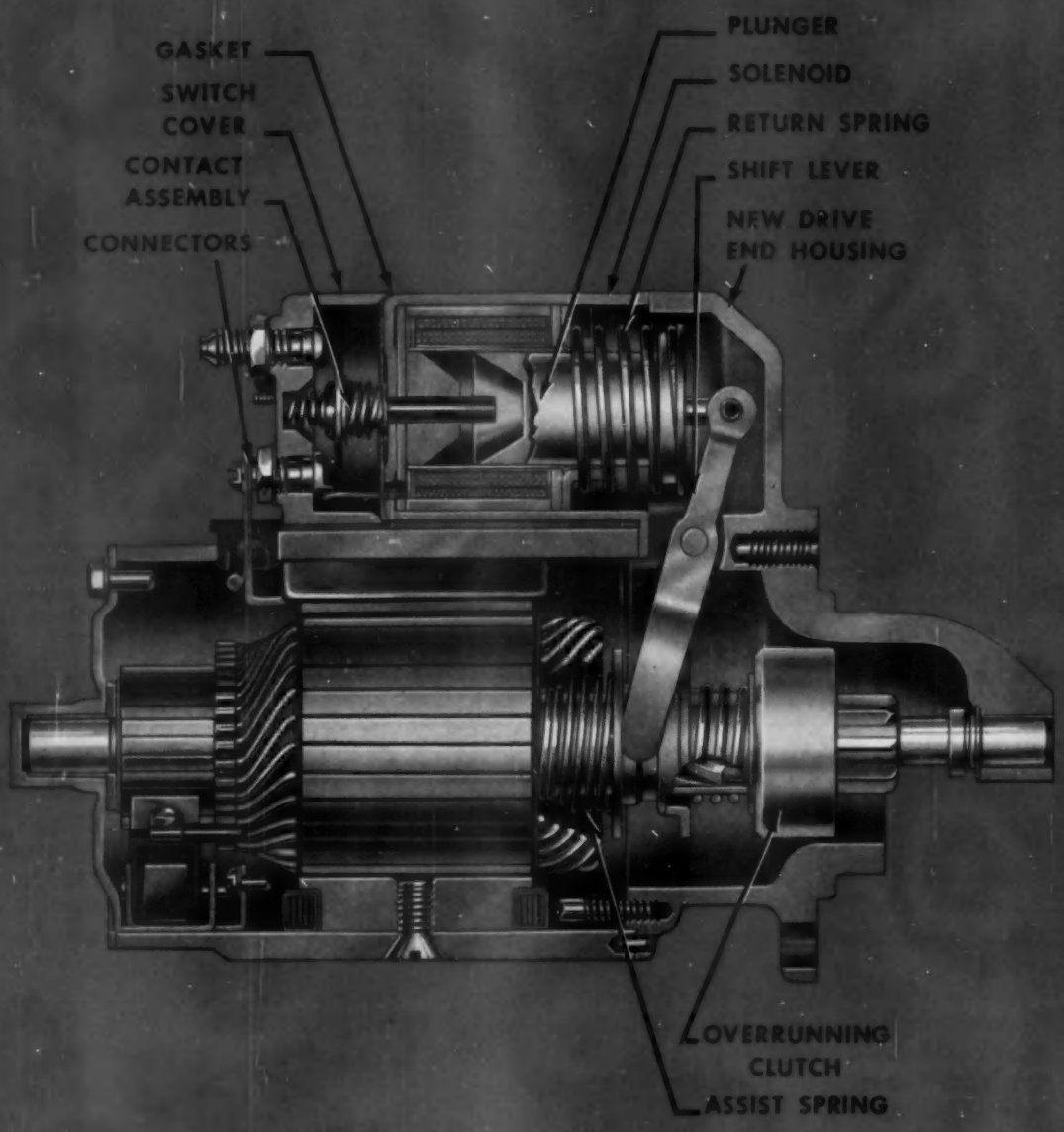
IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

# PROGRESSIVE ENGINEERING MAKES THE DIFFERENCE



# NEW DELCO-REMY ENCLOSED SHIFT LEVER CRANKING MOTOR ON ALL GM CARS IN 1957

Delco-Remy's newly developed Enclosed Shift Lever cranking motor provides effective shielding from road splash, ice and dirt—assures greater starting dependability in all weather—requires no periodic lubrication.

The unique drive end housing completely encloses the entire shift mechanism, including solenoid plunger, lever, lever shaft, and overrunning clutch drive. Specially designed, the new built-in solenoid has a seamless drawn steel case, an improved gasket between case and switch cover, a longer bearing surface for the plunger, and an improved contact assembly with molded insulator actuating rod. The solenoid case is flange mounted tightly to the protective drive end housing, and the switch is electrically connected directly to the motor by extensions of the field coils which pass through an elastic grommet in the frame.

A special compressed assist spring on the armature shaft aids the solenoid during initial movement to provide more positive shift action on engagement. A strong, smooth-acting, compression-type shift lever return spring—located inside the solenoid case—assures quick, unhesitating disengagement from the flywheel.

The new, more compact, smaller diameter overrunning clutch saves vital mounting space—reduces interference problems—makes possible a shorter overall motor length.

This revolutionary new cranking motor—original equipment on all General Motors cars for '57—is another example of Delco-Remy leadership "Wherever Wheels Turn or Propellers Spin."

DELCO-REMY • DIVISION OF GENERAL MOTORS • ANDERSON, INDIANA

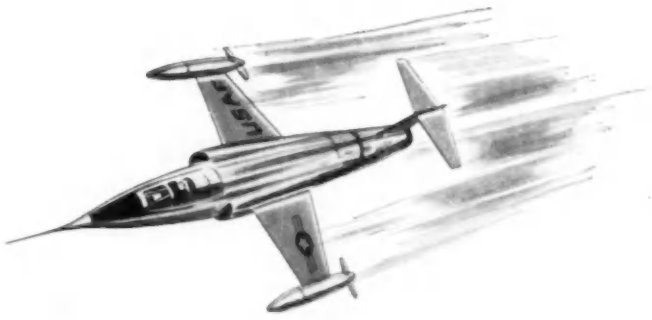
GM GENERAL MOTORS

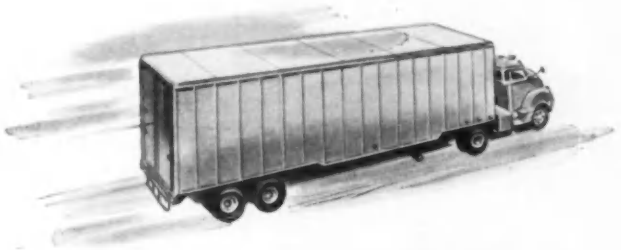
GENERAL MOTORS LEADS THE WAY—STARTING WITH

Delco-Remy

ELECTRICAL SYSTEMS

# *Now... You can make more things of*





# *Stainless Steel*

## The new "200" Series Stainless Steels successfully ease nickel shortage!

With the new low-nickel "200" Series Stainless Steels, producers can greatly expand their output of Chrome-Nickel stainless from existing nickel supplies. These steels provide practical, workable grades of stainless that can be applied to a wide variety of uses.

Made of Chromium-Nickel-Manganese—the "200" Series steels are helping to meet constantly growing needs in transportation, building, manufacturing and many other fields. They're becoming increasingly popular in kitchen utensils, appliances, truck bodies, trains, automobile trim, and scores of products for industrial, home and business use. For further information, see your stainless steel supplier, or write Electromet—leading producer of more than 100 alloys, including chromium and manganese, for the steel and non-ferrous metal industries.

**ELECTRO METALLURGICAL COMPANY**
*A Division of Union Carbide and Carbon Corporation*
**30 East 42nd Street** UCC **New York 17, N. Y.**

The term "Electromet" is a registered trade-mark of Union Carbide and Carbon Corporation

**Electromet**

***Metals do more all the time... Thanks to Alloys***

*Offices:* BIRMINGHAM • CHICAGO • CLEVELAND • DETROIT • LOS ANGELES • HOUSTON • PHILIPSBURG, N. J. • PITTSBURGH • SAN FRANCISCO

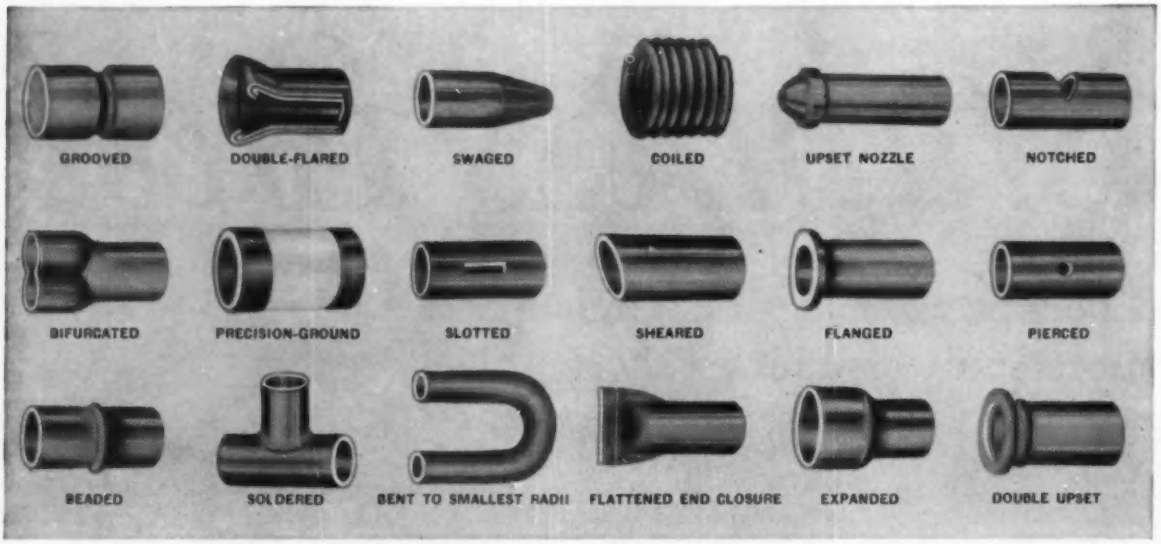
# Call on Bundy for the best in

## Bundy engineers and versatile Bundyweld Tubing can beat the knottiest tubing design problems

IF YOU think it can't be done with tubing, it's a challenge to Bundy®. For years, Bundy engineers have specialized in working with customers and prospects, solving the insolvable. A unique combination of imagination and experience, plus the extreme versatility of Bundyweld® Steel Tubing, has paid off again and again.

Check first with Bundy for workable solutions to your tubing design problems. Whether you are in the design, developmental, or application stage of your product, Bundy will be glad to work with you. Hundreds of manufacturers have already used this Bundy service to advantage.

For instance, if your particular product involves bending small-diameter tubing, you will find, at right, how . . .




Shown above are but a few of the fabrication operations which are possible with Bundyweld Steel Tubing. Many of these, and others not shown, were developed through solving a specific problem brought to us by a customer or prospect. At any stage in the development of your product, Bundy invites you to take advantage of this design service.

**BUNDYWELD IS DOUBLE-WALLED FROM A SINGLE STRIP**

Bundyweld starts as a single strip of copper-coated steel. Then it's . . .

continuously rolled twice around laterally into a tube of uniform thickness, and

passed through a furnace. Copper coating fuses with steel. Result . . .

Bundyweld, double-walled and brazed through 360° of wall contact.

← **NOTE** the exclusive Bundy-developed beveled edges, which afford a smoother joint, absence of bead, and less chance for any leakage.

# tubing, design help, and fabrication

## New mass-produced return bends help you solve design problems where space is limited

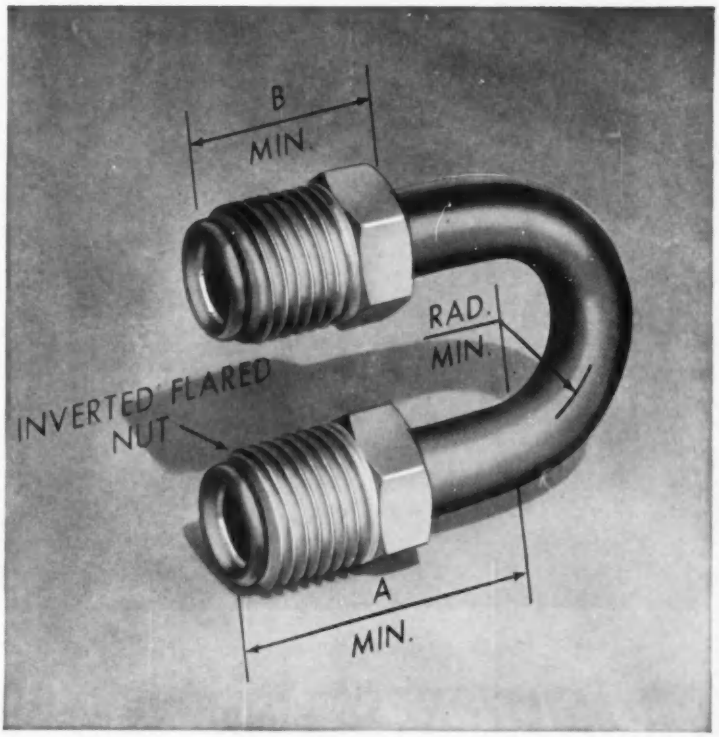
DESIGNING hydraulic actuators for automotive and other uses involves bending tubing to minimum radii, because of severe space limitations in small hydraulic "packages."

At the request of leading fabricators, Bundy has established new minimum standards for the mass production of return bends with fittings attached, in tubing from $\frac{3}{16}$" to $\frac{5}{8}$" O.D. For special problems, where space is more important than speed of production, Bundyweld can be fabricated to even closer tolerances.

Bundyweld Tubing takes such fabrication easily because it's the only tubing double-walled from a single metal strip, copper-bonded through 360° of wall contact. The result: stronger tubing that withstands heavy vibration fatigue, has high bursting strength and high thermal conductivity. No wonder Bundyweld is the accepted standard of the refrigeration and automotive industries: *it is used in 95% of today's cars, in an average of 20 applications each.*

Add Bundy's expert, free engineering service, and you know why Bundyweld Tubing solves even the most difficult tubing problems. Call, write, or wire us today!

**BUNDY TUBING COMPANY**
**DETROIT 14, MICHIGAN**




| TUBE O.D. | 3/16 | 1/4 | 5/16 | 3/8 | 7/16 | 1/2 | 5/8 |
|---|---|---|---|---|---|---|---|
| RAD.-MIN. | 5/16 | 3/8 | 5/8 | 3/4 | 7/8 | 1 | 1 1/2 |
| A-MIN. | 3/4 | 7/8 | 1 | 1 1/16 | 1 1/8 | 1 1/4 | 1 3/8 |
| B-MIN. | 5/8 | 5/8 | 11/16 | 23/32 | 3/4 | 13/16 | 7/8 |
| Bundy Part No. of S.A.E. St'd Inverted Flared Nut | P-2208 | P-2205 | P-2206 | P-2207 | P-2266 | P-2267 | P-2359 |

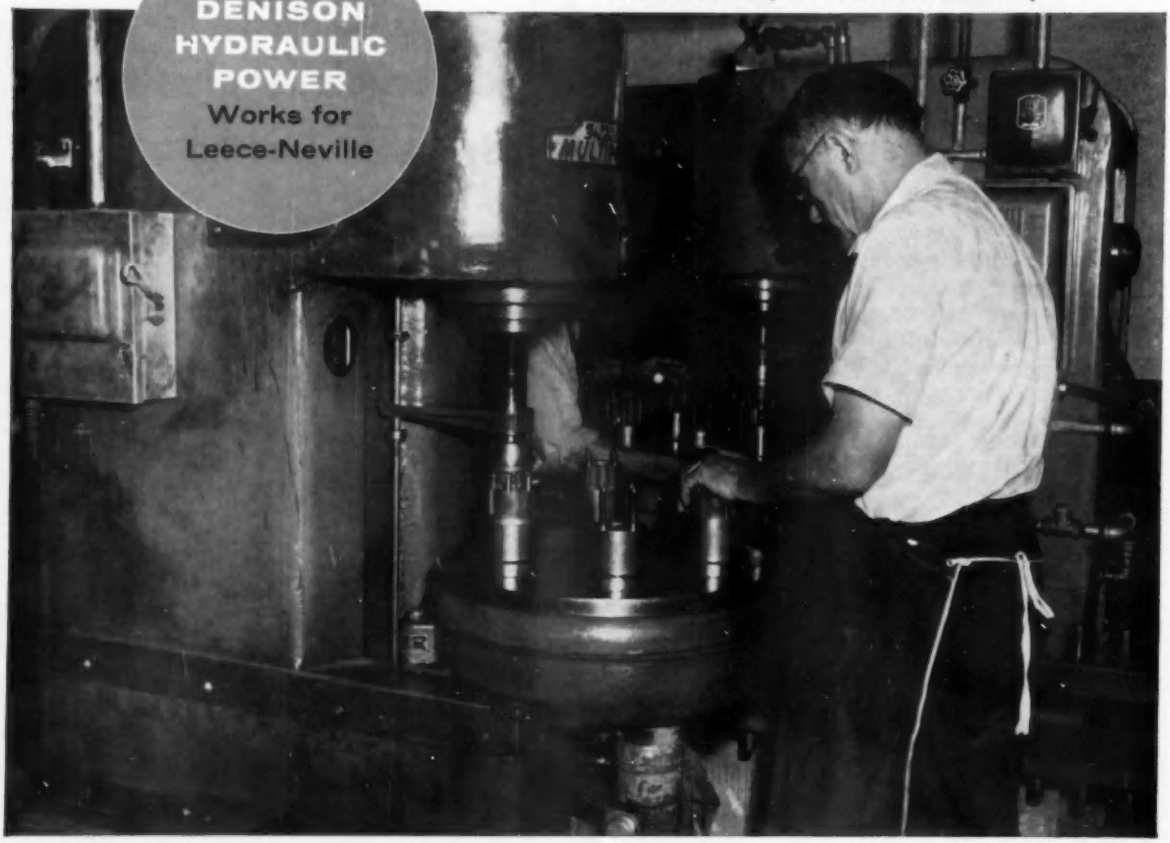
# BUNDYWELD® TUBING

**Bundy Tubing Distributors and Representatives: *Cambridge 42, Mass.:*** Austin-Hastings Co., Inc., 226 Binney St. • ***Chattanooga 2, Tenn.:*** Peirson-Deakins Co., 823-824 Chattanooga Bank Bldg. • ***Chicago 32, Ill.:*** Lapham-Hickey Co., 3333 W. 47th Place • ***Elizabeth, New Jersey:*** A. B. Murray Co., Inc., Post Office Box 476 • ***Los Angeles 58, Calif.:*** Tubesales, 5400 Alcoa Ave. • ***Philadelphia 3, Penn.:*** Rutan & Co., 1717 Sansom St. • ***San Francisco 10, Calif.:*** Pacific Metals Co., Ltd., 3100 19th St. • ***Seattle 4, Wash.:*** Eagle Metals Co., 4755 First Ave., South ***Toronto 5, Ontario, Canada:*** Alloy Metal Sales, Ltd., 181 Fleet St., E. • **Bundyweld nickel and Monel tubing are sold by distributors of nickel and nickel alloys in principal cities.**

***WORLD'S LARGEST PRODUCER OF SMALL-DIAMETER TUBING • AFFILIATED PLANTS IN AUSTRALIA, ENGLAND, FRANCE, GERMANY, AND ITALY***

How **DENISON HYDRAULIC POWER** Works for Leece-Neville

*Six-station index table on 8-ton hydraulic Multipress enables operators to stake rivets on 11,000 lamination stacks in 8-hour period.*



# *MULTIPRESS*® simplifies small motor production

*4,560 brush riggings are assembled every 8 hours in this Multipress operation which eliminates bottlenecks at strategic points in the production process.*

At the Leece-Neville Company, Cleveland, Ohio, fractional horsepower motors are produced around-the-clock. With the help of Denison hydraulic Multipress, automated methods have been incorporated to speed and simplify production.

An example is the use of two 8-ton presses for staking rivets on lamination stacks. In other applications, Multipress assembles brush riggings and armature cores, and notches motor housings. In all of these operations, precision control *plus* savings in time, lost motion and scrap make the investment in Multipress highly profitable.

Denison engineers are specialists at helping *your* company improve product quality. Write Denison Engineering Division, American Brake Shoe Co., 1212 Dublin Road, Columbus 16, Ohio.

**DENISON** HydrOILics

**HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS**

Because these solenoid covers are essential to valve operation, they are chained to the valves. Also, they fasten with 4 "captive" screws that cannot be mislaid. A manual operating button makes it possible to operate the valve without removing its cover.

# Now! solenoid-controlled air valves that defy improper maintenance ...they won't operate with their covers off!

When a solenoid valve operates without its cover, trouble is not far off. Dirt, oil, cutting fluid, chips are sure sooner or later to jam the solenoid, and the valve will fail to shift.

**That can't happen with these new Hannifin valves!**

The solenoids are held in place by their covers and won't operate the valves unless the dust-tight, splashproof covers are firmly tightened.

These new valves, which conform to the latest J.I.C. recommendations, are part of the complete "P-M" Pilot-Master line. New heads with these new solenoid covers are offered on 2-way, 3-way and 4-way Pilot-Master Valves (air-operated). The smaller, direct-operated 3-way and 4-way valves in the "P-M" line have been redesigned to use the same new covers. This added feature is just another reason why it pays to standardize on Hannifin air control valves.

AIR CONTROL

**HANNIFIN**

VALVES

***Complete information*** **on all Hannifin Air Control Valves is in this catalog. It belongs in your files. Write for your copy. Hannifin Corporation, 543 S. Wolf Road, Des Plaines, Illinois.**

**REDESIGNED HEADSTOCK** is massive, rigid casting, eliminating vibration and assuring maximum accuracy. Electric combination clutch and brake permits fast, smooth starts and stops without overheating. The Gisholt main control (manually or hydraulically operated) and the simple push buttons and feed-stop valves speed changeovers. A wide range of spindle speeds permits peak machining efficiency on all materials.

**GISHOLT JETracer** (mounted in place of standard front carriage) for either single or multiple pass work. For latter, JETracer will make up to four consecutive, automatic passes from four templates of different lengths and patterns. **Standard rear independent slide** can operate any time within the general machine cycle to complete the part. **Air- or hydraulically-operated tailstock** can be easily mounted, positioned or removed.

## High capacity + flexibility = economy

# ISN'T THIS WHAT YOU WANT

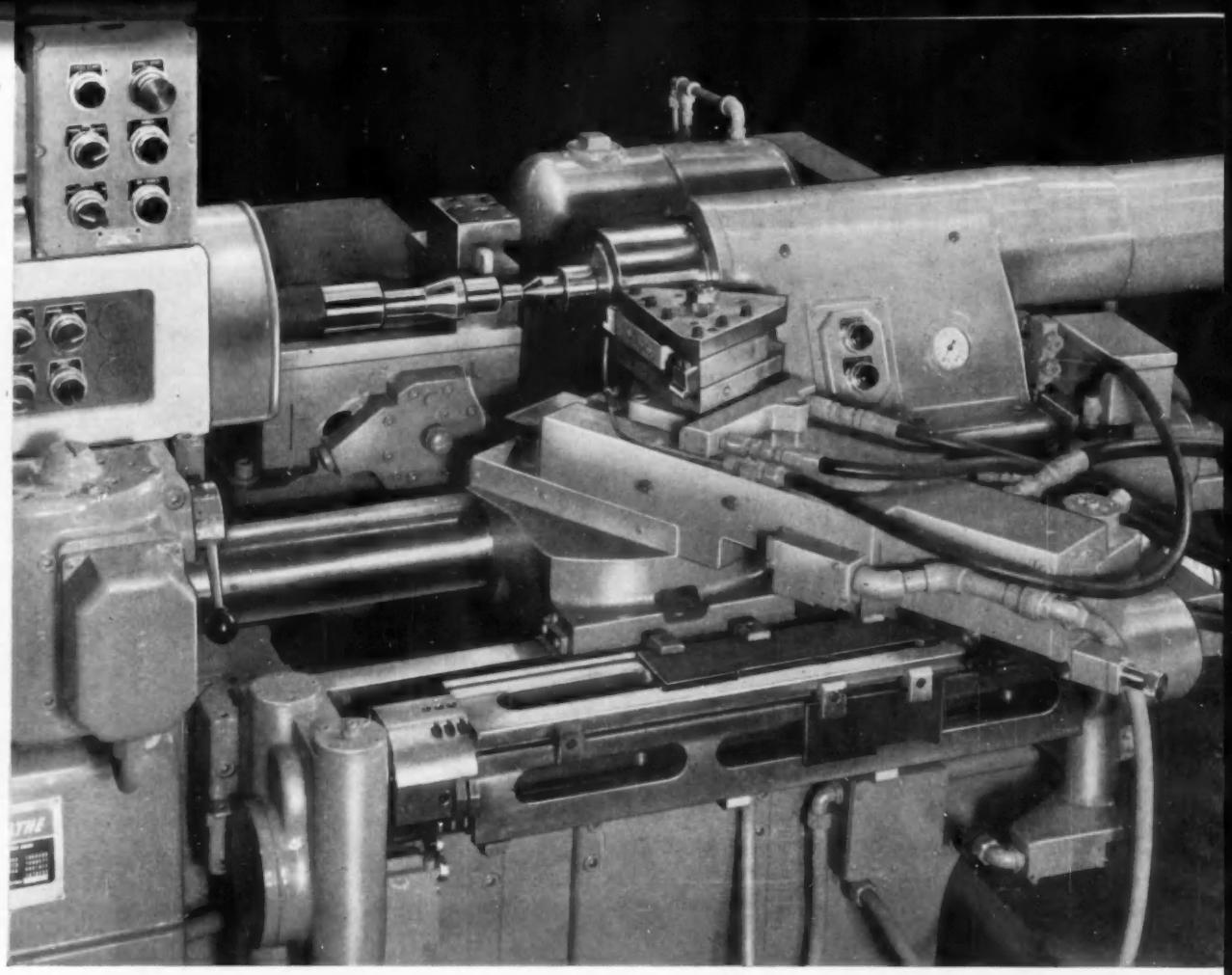
**CONSIDER WHAT YOU CAN DO** with this new Gisholt MASTERLINE No. 12 Automatic Production Lathe:

Here is an automatic lathe designed specifically for high production operations—yet this machine is flexible enough to handle a variety of similar parts in small repeat lots.

You can hold work in a chuck or fixture—with a work driver and tailstock—on an arbor or between centers. To start the automatic cycle, your operator simply loads the part, chucks it and raises the Main Control Lever. He is then free to handle additional machines—or to perform other work—until the part is completed.

On the Gisholt No. 12 Automatic, all carriage and slide movements are hydraulically actuated. The front carriage has both longitudinal and transverse motion—or a combination of the two—with quick approach, automatic tool relief and rapid return. You can mount the rear independent slide at any angle to machine bevel gears, drill cones, or handle other parts with angular surfaces.

For special jobs—like machining both ends simultaneously on small motor frames, cylinder sleeves,



# IN AN AUTOMATIC LATHE?

or similar parts— you get even greater flexibility from the No. 12 through auxiliary slides, operated by movement of the standard slides. Or you can mount a back facing attachment within the spindle—for still another way to machine a maximum number of surfaces in one chucking. And for outstanding versatility with great savings in tool and setup costs, the front carriage on the No. 12 may be replaced by a single- or four-pass JETracer slide.

For complete details of the new features on the Gisholt MASTERLINE No. 12 Automatic Production Lathe, call your Gisholt Representative.

**WRITE GISHOLT TODAY** for advance data on the new Gisholt MASTERLINE No. 12 Automatic Production Lathe. Ask for Form 1178.

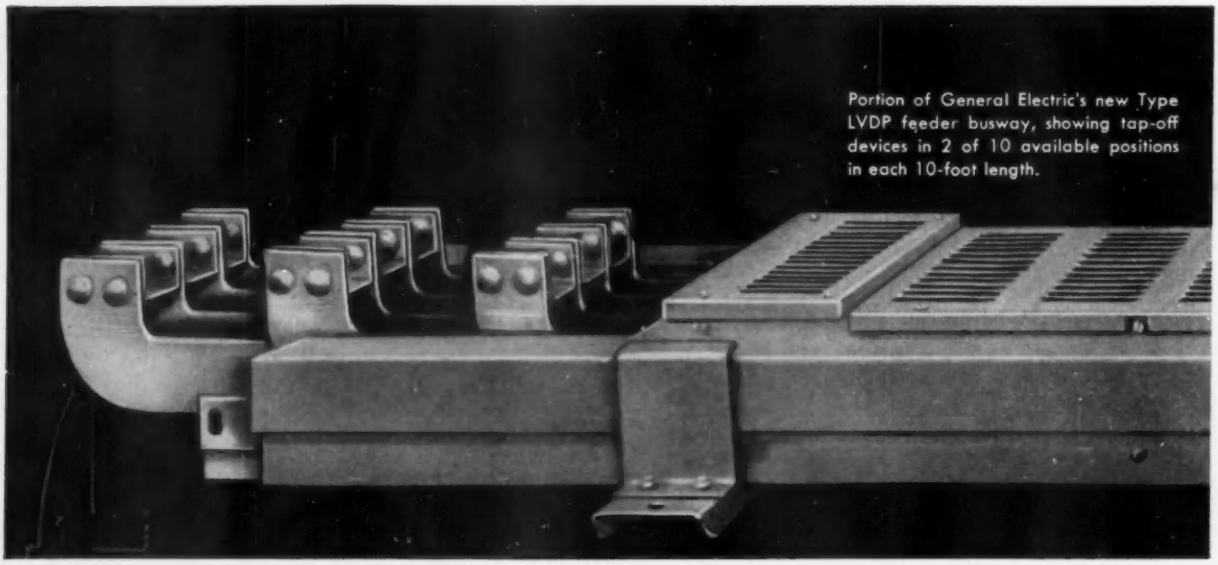
**GISHOLT** MACHINE COMPANY

Madison 10, Wisconsin, U.S.A.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTICS

*New development from General Electric*

# Plug-in Flexibility + Low Voltage Drop + High



Portion of General Electric's new Type LVDP feeder busway, showing tap-off devices in 2 of 10 available positions in each 10-foot length.

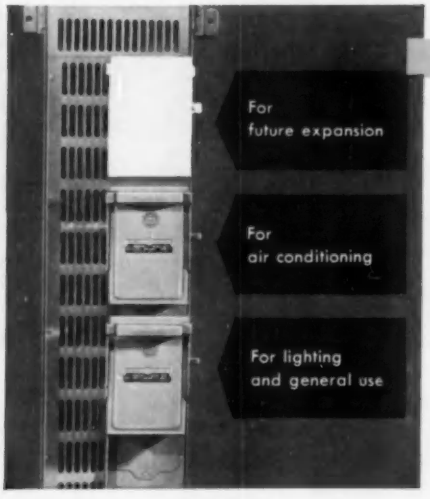
## New plug-in busway, with tap-offs at one-foot intervals, carries large blocks of power (600 to 4000 amperes) with virtually no voltage drop penalty!

A major advance in busway design, the LVDP busway lets you . . .

- **install a primary feeder system at less cost than ever before**
- **lower (and often eliminate) subsequent relocation expense**

**Industrial plants can now relocate tap-off connections in minutes instead of hours.** If equipment such as welders must be moved (no matter how frequently), you merely disconnect your plug and reinsert it at a more convenient place—almost as easily as you do with your toaster at home. You do not have to disassemble and reinstall major busway sections as before.

**Commercial buildings are no longer limited to one tap-off per floor.** You get the convenience of individual metering for each tenant **without adding extra equipment.** As requirements grow, you can increase power available to each floor by simply plugging in additional tap-offs.



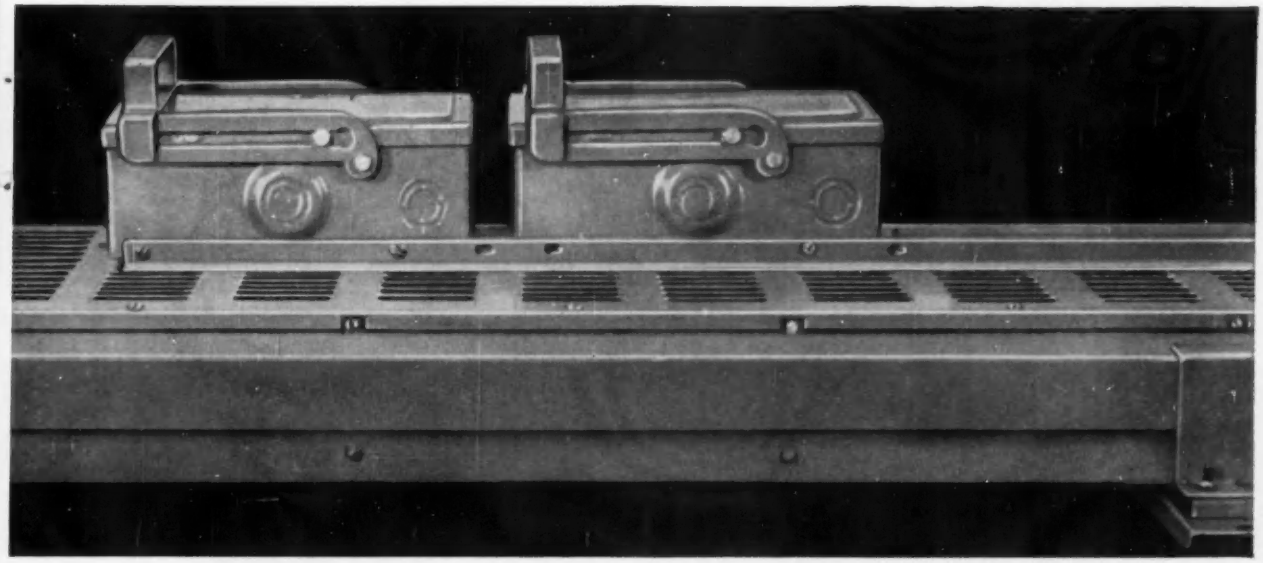

### LOWER INITIAL COST

Eliminate hard-to-install cable tap-off box and separate protective device and substitute a simple plug-in combination tap-off and protective device.

### LOWER REMODELING COST

Now you can relocate equipment or add new equipment without doing anything more than unplugging the tap-off and reinserting it at a more convenient place.

# Capacity—Now in One Feeder Busway!

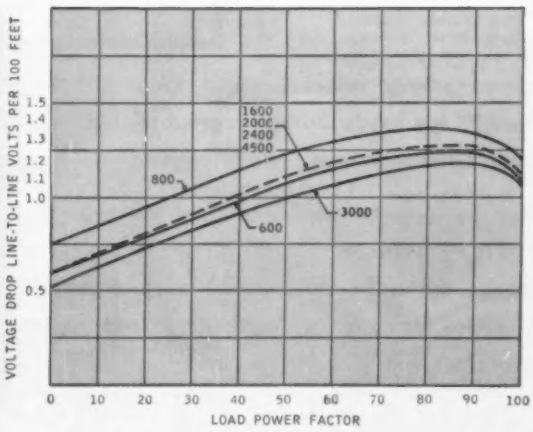


**PLUG-IN FLEXIBILITY:** Rated from 600 to 4000 amperes, the Type LVDP plug-in busway comes in ten-foot sections, each with ten tap-off points for subfeeding through standard General Electric Flex-A-Plug* switch units. Outlets are shielded to prevent accidental contact with bus bars.

**LOW-COST INSTALLATION:** LVDP sections match up with G.E.'s Type LVD feeder busway (similar low-voltage drop, same capacity). When plug-in flexibility is desired, use the LVDP. When no taps are needed, you can select lower-cost LVD busway—straight sections, turns and end boxes.

*Registered trade-mark of The General Electric Company.

**Call your General Electric representative and have him give you all the facts for your next job.**
**Or write Distribution Assemblies Department, General Electric Company, Plainville, Conn.**

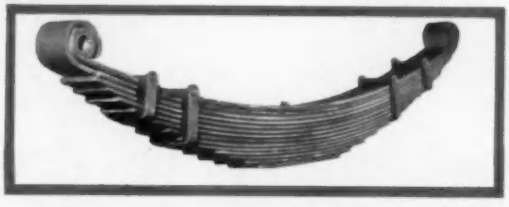



Between the point at which power is brought in and the end of the main feeder, voltage drops of eleven percent and more frequently occur, as shown by a recent survey. The chart at left shows the extremely low voltage drop of General Electric's new Type LVDP plug-in busway with aluminum conductors.

*Progress Is Our Most Important Product*

**GENERAL ELECTRIC**

# Spring Problems SOLVED



THERE'S something colossal about these great DART trucks . . . rolling their 75 ton loads through rugged mining country . . . enduring the roughest kind of service year after year.

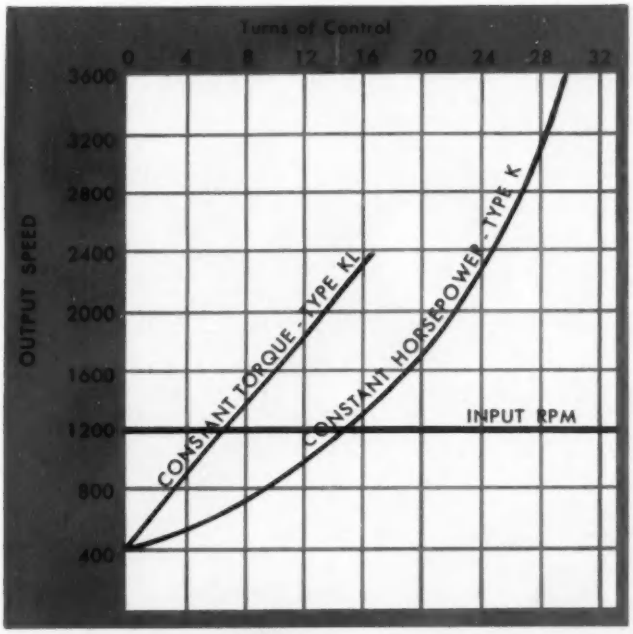
Because of the extreme requirements of this heavy, off-highway equipment, BURTON takes a special pride supplying the springs which contribute vitally to Dart's amazing performance records. No other type of service demands so much or proves so well what BURTON springs can do.

Spring problems solved? Yes . . . and we can solve *yours* too.

**BURTON AUTO SPRING CORP.**

*. . . Vital Support for the Automotive Industry . . .*

**WESTERN AVENUE AT FORTY-EIGHTH STREET • CHICAGO 32, ILLINOIS**




*Typical speed regulation curves for the Types K and KL Variators. Type KL offers a linear speed regulating pattern, often an advantage in automatic control applications. Output speed regulation of the Type K Variator follows a geometric progression pattern. Starting at the minimum output speed, each turn of the speed regulating wheel produces a fixed percentage increase in output shaft speed.*

*The Cleveland Speed Variator is available in 18 models ranging from fractional to 16 HP at 1750 input RPM. Unit shown at right, used in process control, has speed regulating worm driven by 75 RPM synchronous motor, with adjusting shaft indicating mechanism modified to actuate limit switches to prevent overtravel.*

# CLEVELAND SPEED VARIATOR

## Accurately Provides Dependable, Infinitely Variable Speed Control

ANNOUNCED late in 1954, the new Cleveland Speed Variator met instant, enthusiastic acceptance. Engineers and designers of industrial equipment already have put thousands of units into use on such varied equipment as cigarette making machines, textile machinery, metalworking machinery, pharmaceutical equipment, transfer tables, conveyors and experimental and testing equipment of many types.

Infinitely variable, the Cleveland Speed Variator gives stepless speed over a full 9:1 range—from ⅓ to 3 times input speed. Output speed can be adjusted by either a hand wheel on the Variator or by manual or automatic remote control.

*The Cleveland Speed Variator offers these major advantages:*

**1.** An extremely compact unit with input and output shafts in line and rotating in the same direction.

**2.** Almost any input speed up to 1800 RPM can be used—either clockwise or counterclockwise rotation.

**3.** Rated for constant horsepower output over a 9:1 or 6:1 range; or for constant output torque over a 6:1 range.

**4.** Speeds infinitely variable over entire range of adjustment.

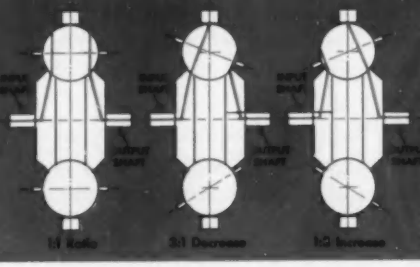
**5.** No slippage—positive torque response mechanism adjusts in direct proportion to the loads encountered.

**6.** Long life and minimum maintenance due to absence of belts or complicated linkages.

**7.** Ample bearing support for overhung pulleys on both input and output shafts.

Write for Bulletin K-200 for detailed description with photographs, sectional drawings, rating tables and specifications.

## HOW THE CLEVELAND SPEED VARIATOR WORKS




Power is transmitted from input shaft to output shaft through alloy steel driving balls which are in pressure contact with discs attached to the two shafts.

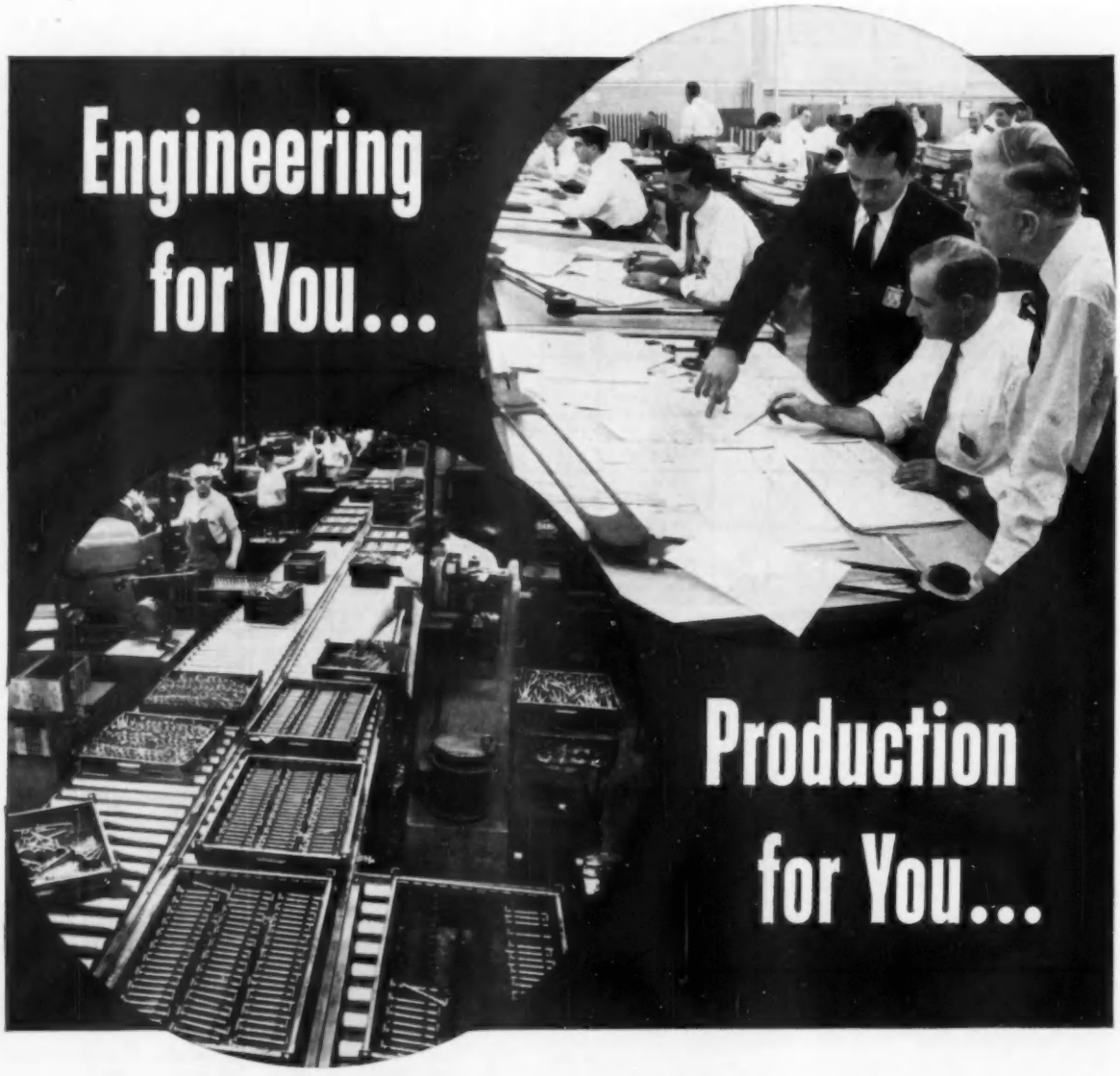
Relative speeds of the shafts are adjusted by changing the positioning of axles on which the balls rotate (diagram, right, shows cutaway Variator with hand regulating wheel).

***"It's the Drive That's on the Ball."***

## THE CLEVELAND WORM AND GEAR COMPANY

Speed Variator Division, 3274 East 80th Street, Cleveland 4, Ohio

*Sales Representatives in all major industrial markets • In Canada: Peacock Brothers Limited.*




## Thompson has these complete facilities

New Valve Division laboratories have modern devices for metallurgical investigations from development of new alloys to trouble-shooting on production-model valves. Out of these laboratories come new valve designs and new materials to keep valve performance ahead of your engine designs.

Adjoining these valve laboratories, the new, expanded plant of the Valve Division is producing Thompson Valves in quantities and quality to meet your stepped-up demands for valves, rotators and other components of the valve train.

When you let the Valve Division handle your requirements, you get the best engineering and production facilities available to the industry.

**Valve Division** Thompson Products, Inc.

1455 EAST 185th STREET • CLEVELAND 10, OHIO

# RB&W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

## *Technical-ities*

By John S. Davey

### Tighten bolts to yield strength?

Actually, it is safer to "overtighten" than to undertighten. The following explains why.

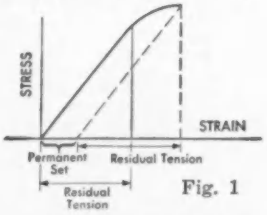



Fig. 1

Up to yield point, the strain in a bolt is proportional to stress. *Beyond* the elastic limit, the bolt goes into its "plastic range". Some permanent stretch takes place. (Fig. 1). Yet while the bolt will not return to original length, note that *residual tension* is fully maintained. And remember, it's *this* force that keeps a bolt tight, determines joint strength.

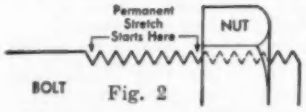
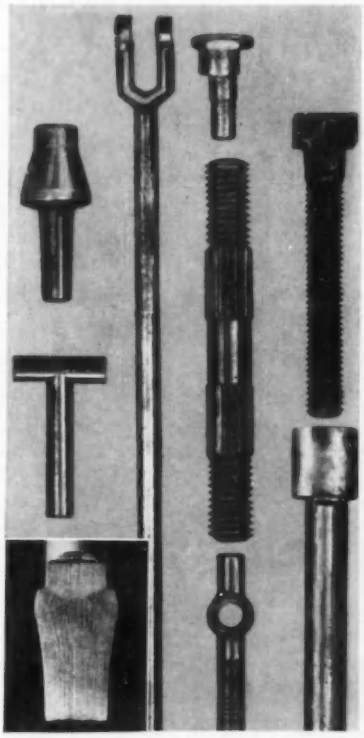



Fig. 2

The permanent set starts at section with highest unit stress —which is at the unengaged threads (Fig. 2). Ultimately, this throws thread pitch off and nut locks, subjecting bolt to torsion (rather than further tightening). This force disappears with wrench-removal. Thus, a bolt can even be torqued well into its plastic range if it won't be reused or need adjustment.

# Cold facts on cold headed fasteners



RB&W cold heading machines have forced metal to flow into this typical variety of shaped pieces—just a handful of thousands of different cold headed shapes produced by RB&W to specification. The upset can be at any point, and the shape need not be symmetrical. The continuous, symmetrical flow lines (inset) make metal stronger.

NO ATTEMPT to simplify, improve or economize on fastening is complete without a good look at your screw machine parts, forgings, and certain assemblies that can be reduced to one piece.

You would be surprised at what an expert can produce on cold headers with complete uniformity. Cold heading produces in one piece parts that would otherwise be two or more.

**BETTER FLOW LINES**

Just as it does with standard fasteners, cold heading makes possible a higher quality, stronger product at high speed and low cost. Properly done, the operation upsets metal along its own axis in continuous flow lines without folds. Stress patterns are better. Fasteners and parts gain greater shear, impact and fatigue strength.

Long a specialist in cold headed fasteners, RB&W offers its experience to designers and production men who want to know whether cold heading is feasible for specific mechanical shapes. If it proves to be so, RB&W facilities can handle your volume needs. Contact Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, New York.

**Plants at:** Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

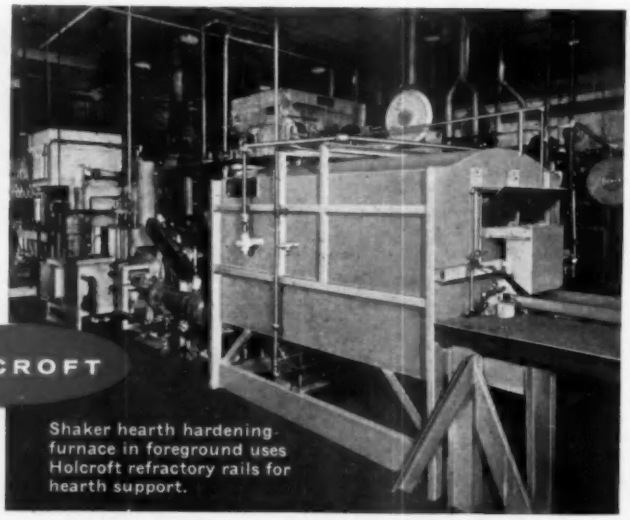
## Spin-Lock® Screws solve assembly problem

The designer specified countersunk-head screws to be used in a particular casting. The production man had to stake these in to anchor them. But this meant extra operation, made screw removal damaging and difficult.

The answer was found in Spin-Lock screws. These have hardened "ratchet-action" teeth that bite in when tightened, take 20% more torque to loosen than to tighten, can be reused. Send for Bulletin.

Spin-Lock "tooth" about to bite in. Head meets seat when fully tightened.

BLAZING THE HEAT TREAT TRAIL— WITH HOLCROFT



Shaker hearth hardening furnace in foreground uses Holcroft refractory rails for hearth support.

LET'S TALK ABOUT

# REFRACTORY RAILS

With the current shortage of nickel, furnace manufacturers are looking for ways to replace or conserve this scarce commodity. It is interesting to note that Holcroft tackled this same problem during World War II when a nickel shortage also faced the industry.

In 1945 we designed and installed a pusher tray gas atmosphere furnace that used refractory skid rails instead of the nickel chrome alloys used at that time. Since then we have expanded their use to many other comparable applications so that now there is positive proof that properly designed installations of refractory skid rails last much longer, under similar conditions, than those made from nickel alloys. Replacements have been negligible—performance has been superior—material costs have been lower—and a marked decrease in wear on work carriers has been noted.

Yes, today a nickel shortage still exists—but Holcroft offers a job-proven answer, not only for the rails but for other vital parts of a heat treat furnace as well. You can bank on Holcroft's engineering leadership and experience—the kind that saves not only nickel—*but dollars, too!* Write for information.

**HOLCROFT AND COMPANY**

6545 EPWORTH BOULEVARD • DETROIT 10, MICHIGAN

PRODUCTION HEAT TREAT FURNACES FOR EVERY PURPOSE

CHICAGO, ILL. • CLEVELAND, OHIO • HARTFORD, CONN. • HOUSTON, TEXAS • LOS ANGELES, CALIF. • PHILA., PA.

CANADA: Walker Metal Products, Ltd., Windsor, Ontario

# CALENDAR

## OF COMING SHOWS AND MEETINGS

1957

Second International Automobile, Motorcycle, and Bicycle Show, Mexico City .....Jan. 4-13

Chicago Automobile Show, International Amphitheater, Chicago, Ill. .....Jan. 5-13

SAE Annual Meeting, Sheraton-Cadillac and Statler Hotels, Detroit, Mich. .....Jan. 14-18

Society of Plastics Engineers, annual national technical conference, Sheraton-Jefferson Hotel, St. Louis, Mo. .....Jan. 16-18

Engineers Joint Council General Assembly, annual meeting, Hotel Statler, New York, N. Y. ...Jan. 17-18

International Management Association, special conference on foreign operations, Roosevelt Hotel Jan. 17-18

Detroit Automobile Show .....Jan. 19-27

National Motor Boat Show, Coliseum, New York, N. Y. ....Jan. 19-27

American Institute of Electrical Engineers, winter meeting, Statler Hotel, New York, N. Y. Jan. 21-25

National Automobile Dealers Equipment Exhibition, Civic Auditorium, San Francisco, Calif. Jan. 26-30

Plant Maintenance & Engineering Show, Public Auditorium, Cleveland, O. .....Jan. 28-31

American Roadbuilders Association, road show and convention, International Amphitheater, Chicago, Ill. .....Jan. 28-Feb. 2

Automotive Accessories Manufacturers of America, exposition, Coliseum, New York, N. Y...Feb. 4-7

Society of the Plastics Industry, 12th annual Reinforced Plastics Div. Conference, Edgewater Beach Hotel, Chicago, Ill.....Feb. 5-7

American Management Association, conference on nucleonics in industry, Statler Hotel, New York, N. Y. .....Feb. 7-8

SAE National Passenger Car, Body, and Materials Meeting, Sheraton-Cadillac Hotel, Detroit, Mich. .....Mar. 5-7

Pressed Metal Institute, annual spring technical meeting, Hotel Carter, Cleveland, O. .....March 6-8

Pacific Automotive Show, Civic Auditorium, Seattle, Wash..Mar. 7-10

Atomic Exposition and Nuclear Congress, Convention Hall, Philadelphia, Pa. .....Mar. 11-15

National Industrial Conference Board, fifth conference on Atomic Energy, Philadelphia, Pa. .....March 14-15

Geneva Automobile Show, Switzerland .....March 14-24

Society of the Plastics Industry, annual national conference and Pacific Coast plastics exposition, Los Angeles, Calif. .March 18-21

SAE National Production Meeting and Forum, Hotel Statler, Buffalo, N. Y. .....March 20-22

American Society of Tool Engineers, silver anniversary technical meeting and convention, Shamrock Hilton Hotel, Houston, Tex. .....March 25-27

Western Metal Congress and Exposition, Los Angeles, Calif., March 25-29

American Welding Society, national spring meeting and fifth welding and allied industry exposition, Philadelphia, Pa. ....April 8-12

# The ring of quality

Colorful, low-cost sidewall rings that can be quickly installed on tires are now contributing to the luxury-look of today's new cars. They're inexpensive, stay brilliant for life, wash bright in seconds, out-last tires. A product of The Bearfoot Sole Co., Wadsworth, Ohio, these rings are available in a variety of colors or in white. They're made of Enjay Butyl Rubber because no other rubber tested could equal its performance in severe laboratory and road tests. The Enjay Butyl label on the Flex-A-Wall® carton assures the buyer of outstanding quality.

Find out for yourself the many technical advantages of Enjay Butyl—the rubber that is outperforming natural and other types of rubber in a wide variety of industrial and consumer applications. For full information, and for technical assistance in the use of Enjay Butyl, write, wire or phone the Enjay Company.

ENJAY BUTYL

ENJAY *Pioneer in Petrochemicals*

**ENJAY COMPANY, INC., 15 West 51st Street, New York 19, N. Y.**

*Other offices: Akron • Boston • Chicago • Los Angeles • Tulsa*

Enjay Butyl is the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

SURE, POWER STEERING MAKES THE JOB EASIER. BUT IT'S THE ADDED SAFETY THAT COUNTS MOST.
OUR POWER-STEERED RIGS STAY ON SCHEDULE BETTER, TOO.
EITHER WAY, POWER STEERING MAKES GOOD BUSINESS SENSE.
6269

# THE CASE FOR POWER STEERING ON TRUCKS!

The trend to power steering on trucks is based on one very practical reason —operators of trucks equipped with power steering have invariably found that the added safety and greater operating efficiency of their vehicles have demonstrated that power steering is indeed a sound investment.

Truck drivers using power steering report less tension and fatigue in normal driving and appreciate the positive control that blocks road shock from chuck holes and prevents loss of control if the truck is forced out on a soft shoulder.

The dispatcher knows the importance of regularly maintained schedules. He is quite aware that with power steering drivers are more relaxed and are better drivers than tired drivers. Thus, power steering not only reduces the hazard of road accidents, but helps the driver to maintain established schedules through better vehicle control.

In short, power steering, by saving time and money, contributes materially to a more profitable operation.

Truck manufacturers are always eager to offer their customers features that will make truck operation safer and more profitable and, at the same time, give their dealers every selling advantage.

That's why more and more truck manufacturers are offering performance-proven Bendix* Power Steering as original factory equipment.

If you would like to know why power steering for trucks is perhaps even more logical than power steering for passenger cars, we have prepared an interesting folder on the subject.

Write for your copy today. We think you'll be convinced. *REG. U.S. PAT. OFF.

Bendix PRODUCTS DIVISION South Bend IND.

Bendix AVIATION CORPORATION

AUTOMOTIVE INDUSTRIES

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# High Spots of This Issue

## ★ 100 Per Cent Increase in Aluminum for Car Trim

Always a popular material for a variety of applications on automobiles, aluminum has really come into its own on the 1957 cars. This survey pinpoints a number of specific uses to which it is being put by the makers. See Page 48.

## ★ Mechanized Battery Plant Has Automatic Assembly Line

Sterling example of an up-to-date plant for the manufacture of car batteries is the Olathe, Kans., facility of Delco-Remy Div. of General Motors Corp. The author's visual tour shows the extent of automation used therein. See Page 50.

## ★ Modernized Foundry for High Piston Production

Output capacity at the Highland Park, Mich., aluminum piston foundry of Chrysler Corp. has been boosted to 75,000 a day. This phenomenal rate has been achieved through the installation of a wealth of new facilities. See Page 56.

## ★ Quality Control Vital in TorqueFlite Production

Meticulous attention to detail is paid along every step of the way in the building of automatic transmissions at the Chrysler Kokomo, Ind., plant. Highlighted in this article is the devotion accorded to quality control. See Page 56.

## ★ SAE National Diesel Engine Meeting

Design and testing were the two principal spheres of interest at the SAE National Diesel Engine Meeting in Chicago last month. Brief discussions of the important papers presented are given here in digest form. See Page 100.

## ★ 40 New Product Items And Other High Spots, Such As:

Eldorado Brougham; AGMA symposium; leaf spring design; what price executives?; ICI annual meeting; anti-tank vehicle; British automatic transmission; metal finishing show; double-reduction axles; and Industrial Hydraulics conference.

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AUTOMOTIVE INDUSTRIES COVERS
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# BUYERS GUIDE TO STAINLESS

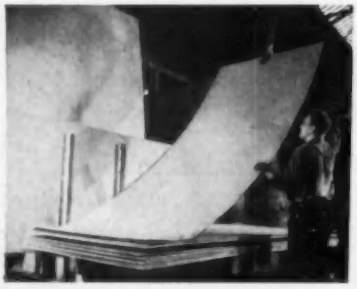
## A Directory of Ryerson Stainless Steels and Services

Here's a quick guide to the nation's largest stocks of stainless steel—2,351 sizes, shapes, types and finishes of Allegheny stainless in stock at Ryerson.

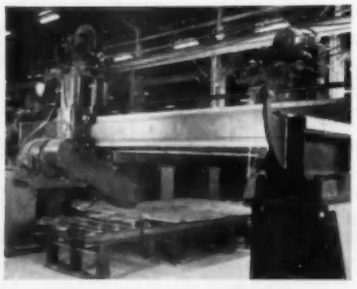
This wide selection assures you of getting the best stainless for every application. Extra care in storage, handling and shipping—such as padded shear clamps to protect finish and flatness of sheets—guards the high quality of Ryerson stainless stocks. And in addition, the help of full-time stainless specialists is yours when you call Ryerson.

See your Ryerson catalog for a complete listing of stocks and call your nearby Ryerson plant for quick shipment of Allegheny stainless—one piece or a truckload.

**SHEETS**—11 analyses of Allegheny stainless sheets in stock including nickel and straight chrome types. Also extra wide sheets to reduce welding costs.



**PLATES**—Available in 9 analyses including plates to Atomic Energy Commission requirements and to ASTM specifications for code work. Also extra low carbon types for trouble-free welding.



**TRUE-SQUARE DISC CUTTING**—Stainless plates up to 12' x 25' cut absolutely square on abrasive disc machine. Length and width tolerance plus or minus 1/32".

**A NEW STEEL**—Type 202 Allegheny Stainless is available in 14 to 26 gauge sheets. Type 202 compares favorably with 302 in corrosion resistance, costs 2¼¢ per lb. less.

**BARS AND ANGLES**—Rounds, squares, flats, hex's and angles in 8 types including free-machining bars with both analysis and mechanical properties controlled for best performance.

**CIRCLES, RINGS, SPECIAL SHAPES**—Practically any shape, no matter how intricate, can be accurately flame cut from stainless steel plate by skilled Ryerson operators.

**PIPE AND TUBING**—Light wall, standard and extra heavy pipe, ornamental and regular stainless tubing. Also flanged, screwed, welding and Quikuple fittings and Cooper stainless valves.

**AIRCRAFT STAINLESS**—Sheets, strip, plate and bars to Government and Aeronautical Specs. Write for Ryerson Aircraft Steels booklet.

# RYERSON STEEL

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News of the AUTOMOTIVE AND AVIATION INDUSTRIES

Vol. 115, No. 12 December 15, 1956

### GM Plans $700 Million Capital Outlay for 1957

Harlow H. Curtice, president of General Motors Corp., disclosed that the company will spend $700 million for capital improvement in 1957 to take full advantage of the current technological progress in the machine tool industry. He also predicted a record breaking year for the economy if the "delicate balance" of peace is maintained, and a 10 per cent increase in passenger car sales over 1956.

Mr. Curtice told newsmen at a press conference preceding the opening of the National Automobile Show in New York City that GM capital expenditures for 1957 will be second only to the amount expended for this year, which is just under the $1 billion mark. He stated that although depreciation reserves will not cover the full capital outlay planned for next year, the company will not need outside financing.

The GM president expressed the belief that about 6.5 million cars and 900,000 trucks will be produced next year in the domestic market. This estimate of 1957 production and sales agrees very closely with forecasts made by Ford and Chrysler company officials, which they expressed privately at the show.

Mr. Curtice estimated that General Motors' share of the automobile market in 1956 would amount to about 51.8 per cent. This compares with a 50.8 per cent figure for 1955. He also added that the company does not intend to restrict its sales during the coming year.

"You don't stand still in this industry," he stated. "You either go forward or you go backward—and we have no plans for going backward."

Commenting on the tight money situation, the GM president expressed confidence that even though new money for cars is not plentiful, enough would be available to finance the sales of 6½ million passenger cars next year. He also added that he does not expect any further price increases on passenger cars in 1957.

Mr. Curtice said that GM has no plans at the present time either to import cars from its foreign plants for sale in this country, or to produce a small European-type car in its own plants. He explained that neither Vauxhall nor Opel have the capacity to supply their own market; but, if the time comes when they do, GM will consider the former possibility. He also strongly denied the rumor that GM will go into unit construction in 1958.

**SWEDISH CAR FEATURES ECONOMY OF OPERATION**

*The new Amazon by Volvo has a four-cylinder engine of 96 cu in. displacement. Rated at 60 bhp at 4500 rpm, it drives through a three-speed gearbox. The car features all independent suspension with coil springs for the riding comfort of passengers.*

### Fuel Injection Is Announced By Pontiac, American Motors

Surprise announcements by Pontiac and American Motors that both will offer fuel injection systems on certain 1957 models is a sign that the use of fuel injection may spread throughout the industry sooner than expected. With three car companies now officially announcing the availability of the system, it is almost certain that others will release details about their units in the coming months. Oldsmobile also is testing a fuel injection system, but considers it still too costly for production models.

Pontiac's unit, to go into limited production early next year, is designed for the Bonneville six-passenger sports convertible, shown at the National Automobile Show this month. In all likelihood, it will not become available to the public for some time, since initial production will be designed for dealers' use only for testing under actual field conditions.

American Motors will offer the Bendix electronic fuel injection unit on the Rambler. It is the first car company to use this particular unit, announced by Bendix several months ago. The unit will be offered on a new model called the Rambler Rebel, which will carry the 327 cu in. V-8 engine made by AMC. When equipped with the new fuel injection system—designated the Electrojector — the engine, which develops 255 hp with normal four-barrel carburetion, will be rated at 288 hp.

# News of the AUTOMOTIVE

### International Harvester Unveils Semi-Automatic Transmission

International Harvester Co. has introduced a new semi-automatic transmission for its heavy-duty trucks. It was displayed for the first time at the National Automobile Show held in New York this month.

Called the Select-O-Matic, the new unit features an electro-hydraulic clutch and high-efficiency converter, in combination with a five-speed syncromesh transmission. The driver can control gear selection at all times. By pressing a button, located under the gearshift knob, he can release the clutch.

The converter doubles the torque transmitted to the wheels during starting and also prevents engine lugging. It is available in either 13 or 14 in. sizes, and each size has an appropriate number of fins and spacing enabling the converter to deliver maximum torque from a power plant of specified horsepower. The same type hydraulic fluid is used in both the transmission and the torque converter.

### Ford Displays New Truck At New York Auto Show

Star of the Ford truck exhibit at the Show was the new 1957 heavy-duty Tilt Cab model. Replacing the 1956 Ford Cab Forward models, the Tilt Cab trucks are designed in six models with gross vehicle weight ratings of 18,000 to 30,000 lb. Each model can be ordered in four wheelbase lengths ranging from 99 to 153 in. A series of short-stroke V-8 engines ranging from 171 to 212 hp is available.

*Ford Tilt Cab truck.*

Length of body from front bumper to rear of cab is only 80.3 in., compared to 111.1 in. for the heavy conventional truck. Cab is hinged to the frame at the front and swings forward on spring pressure when a safety catch is released. The engine and transmission are thus exposed for rapid maintenance work.

*Chrysler 300-C sedan has a simple classic exterior in the sports car tradition.*

### New Subsidiary Set Up by Budd To Produce Measuring Systems

The Budd Co. has announced recently the establishment of a new wholly-owned subsidiary, the Tatnall Measuring Systems Co. It will be under the direction of Francis G. Tatnall, who will serve as vice-president and general manager.

The new concern will develop systems not now in existence that will automatically combine the three functions of sensing or detecting, recording and correcting—the elements of measurement—for a broad variety of industries and uses.

### Chevrolet's Flint Plant Builds Millionth Frame

Chevrolet's frame and stamping plant in Flint, Mich., last month turned out its one millionth automobile frame. It took the plant approximately two years to achieve this.

### Chrysler Presents 300-C Car at New York Automobile Show

Presented to the public for the first time at the Show was the newest car in the Chrysler 300 series. Powered by a FirePower V-8 engine of 392 cu in. displacement with a compression ratio of 9.25 to 1, the 300-C has a special torsion bar suspension for flat cornering and what is said to be almost dip-free braking.

The power plant develops 375 bhp at 5200 rmp on premium-grade gasoline. Maximum torque is 420 at 4000 rpm, and two four-barrel carburetors are used. Bore is 4 in., and stroke is 3.9 in. High-output camshaft, rocker arm valve adjustment, and dual exhaust system are featured, while a complete range of rear axle ratios is offered.

An optional performance group available on the 300-C consists of a 10 to 1 compression ratio, high-speed camshaft, low back-pressure exhaust system, limited slip differential, and manual transmission and steering.

### Automobile Workers Get 2-Cents-An-Hour Increase

A further rise in the cost-of-living index has nudged wages up two cents an hour for workers in the automotive and other industries which have contracts tied to living-cost provisions. The increase is based on the Bureau of Labor Statistics Index, which rose from 117.0 in July to 117.7 on Oct. 15. The next adjustment in the cost-of-living allowance will be made in March based on the Jan. 15 index.

# AND AVIATION INDUSTRIES

### *New Edsel Car May Be First of 1958 Models*

Ford's upcoming new car, the Edsel, will be introduced early next fall and may possibly be the first 1958 car to be announced. Production of engines for the new car at the Lima, O., plant should hit full schedule by late June.

The Edsel reportedly will be priced between the Mercury and Lincoln and will have at least two series on different wheelbases. Some sheet metal parts will be interchangeable with Ford in one series, and with Mercury in another. However, the Edsel will be distinctly individual in styling.

The Special Products Div., recently renamed the Edsel Div., will build the cars in six or seven company plants. Plans call for at least 200,000 cars the first model year and much greater production thereafter.

About 1200 new dealers will be signed by introduction day, some of them from existing Ford lines and some from the outside. Approximately 450 suppliers will be building components for the Edsel car. The company already has signed up more than 90 of them, including such firms as King-Seeley Corp., Kelsey-Hayes Wheel Co., Dana Corp., Rockwell Spring & Axle Co., Houdaille Industries, Inc., and Stromberg-Carlson Div. of General Dynamics Corp.

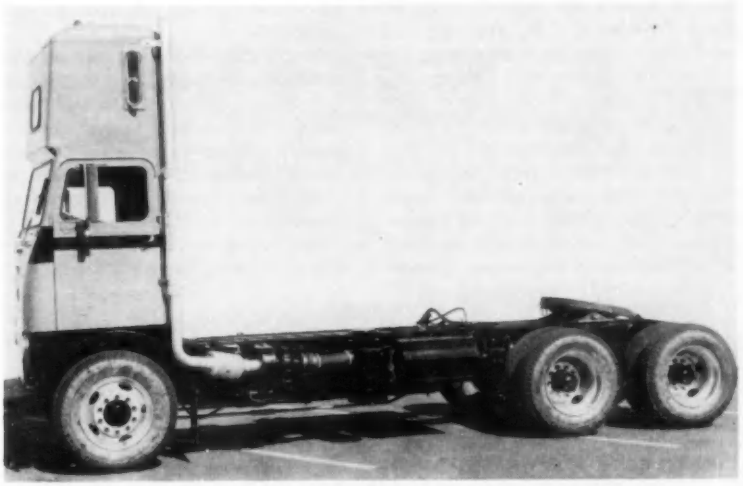
### *Willys Counts On New Vehicle To Boost Sales For Next Year*

Evidence that Willys Motors, one-time automobile manufacturer, plans to expand its automotive business, came recently at a press conference and dealer preview of its newest vehicle in the Jeep line. Designated the FC-150 model (see AI, Dec. 1, 1956, p. 36), the vehicle is part of a projected complete line of specialized vehicles which will fit into practically every type of industry and business. If successful, the vehicle, a forward-control model will be expanded considerably next year to include larger-type units.

Some reports that Willys is considering re-entering the passenger car market were denied flatly by Edgar F. Kaiser, president of Willys and its parent company, Kaiser Industries Corp., under which Willys was reorganized. While Kaiser did not go into specific details about Willys' profit position since the automobile line was dropped, he said he anticipated "a very good profit year" for Willys in 1956.

Willys is currently doing a $140 million annual sales volume compared with $120 in 1955. Willys operations today stretch into 150 countries, and it has assembly and distribution plants located in 20 of those countries.

The FC-150 forward-control model represents the company's first major alterations in its four-wheel drive vehicles in 12 years. It has substantially more cargo space than present models, although it has the same wheelbase and tread. The vehicle, which falls between the small Jeep and the Jeep truck, is being turned out at Willys' Toledo plant, with present output running between 1300 and 1400 units a month. Advertised delivered prices on the new vehicle will range from $2334 to $2394.



**WHITE SPACEMAKER SERIES CARRIES EXTRA LOAD**

*The new White Spacemaker series of trucks and tractors consists of six basic models. They are available in a variety of wheelbase lengths and with a choice of major components to fit a variety of needs. Chassis shown here is the new WF4864DD dual drive tractor with a Cummins NHHT horizontal Diesel engine. It has a 188-in. wheelbase and can carry an 8½ ft. dromedary box and pull a 35-ft trailer for a total of 43½ ft of loading space within a 50 ft overall length, according to the manufacturer.*

### *Atomic, Missile Developments Featured at Power Exposition*

The tremendous expansion taking place throughout the power and mechanical industries was highlighted in the over 300 exhibits at the National Power Show in New York City's Coliseum last month. Held in conjunction with the 76th annual meeting of the American Society of Mechanical Engineers, it drew thousands of visitors during its five-day run from Nov. 26 to 30.

Innovations at the 22nd annual event included a new Atomic Section and Rocket and Missiles Section. The latter was sponsored by the American Rocket Society, which held its 11th annual meeting to coincide with the ASME affair. While the missiles and atomic sections occupied a comparatively small portion of the two exhibition floors, their components were displayed in nearly every booth.

Rocketdyne, a division of North American Aviation, Inc., focused attention on its propulsion systems for missiles. Clue to the progress which the firm is making in the field was the disclosure that it will open on

# News of the AUTOMOTIVE

Feb. 1 a new $13 million plant at Camp Crowder, Mo., for assembly line production of ramjet engines.

Other developments in the rapidly advancing ramjet engine field were found in the displays of Bendix Aviation Corp. and Reaction Motors, Inc. Already extensively flight tested, the Bendix ramjet engine system is a supersonic, high-thrust type with automatic speed regulation. It is designed to give optimum performance under an extreme range of environmental conditions.

The Reaction Motors ramjet is a small rocket engine that is used on helicopters to provide power assistance for take-offs, raise hovering power, and increase power-off glide range. Details of its design and operation remain under security restrictions.

Subject of considerable interest at the show was the Navy's exhibit of a model of the first man-made earth satellite. It is being developed for Project Vanguard, on which Martin Co. is prime contractor, and is due to be launched into space next year.

Also an object of much attention was a working model of a free-piston engine shown by Gulf Oil Corp. Other engine developments exhibited were the Napier opposed-piston type, and American Turbine Corp.'s closed-cycle gas turbine nuclear propulsion plant.

The demand for aircraft components of greater strength and heat resistance is being heeded by T. R. Finn & Co. and Dow Chemical Co. Sheet metal parts for jet and ramjet engines were presented by the former at the show, while Dow technical personnel were on hand to discuss a new magnesium alloy for high-temperature aircraft applications.

Other exhibits of special interest included plastic dies used in the manufacture of automotive and aircraft parts displayed by Thiokol Chemical Corp., a new Inco welding electrode for welding dissimilar alloy combinations, and a new saw shown by DoAll Eastern Co., Inc.

## 1956 WEEKLY U. S. MOTOR VEHICLE PRODUCTION

*As reported by the Automobile Manufacturers Association*

| Make | For Weeks Ending Dec. 1 | Nov. 24 | Nov. 17 | Nov. 10 | Total Jan. 1 to Dec. 1, 1956 |
|---|---|---|---|---|---|
| **PASSENGER CAR PRODUCTION** | | | | | |
| Hudson | 102 | 0 | 27 | 143 | 22,051 |
| Nash | 545 | 0 | 119 | 534 | 53,272 |
| Rambler | 1,906 | 0 | 371 | 1,877 | 18,602* |
| Total—American Motors | 2,553 | 0 | 517 | 2,604 | 93,925 |
| Chrysler and Imperial | 3,206 | 2,166 | 2,746 | 2,061 | 94,039 |
| De Soto | 3,416 | 2,663 | 3,415 | 2,953 | 90,792 |
| Dodge | 7,576 | 4,335 | 4,758 | 4,118 | 178,665 |
| Plymouth | 14,486 | 10,169 | 12,257 | 10,871 | 400,130 |
| Total—Chrysler Corp. | 28,754 | 19,333 | 23,186 | 19,953 | 763,626 |
| Ford | 40,252 | 32,257 | 36,803 | 37,285 | 1,223,313 |
| Lincoln and Continental | 1,084 | 823 | 830 | 870 | 44,388 |
| Mercury | 6,266 | 5,281 | 5,479 | 4,133 | 219,166 |
| Total—Ford Motor Company | 47,582 | 38,358 | 43,112 | 42,288 | 1,486,867 |
| Buick | 13,949 | 9,456 | 10,086 | 8,313 | 481,118 |
| Cadillac | 3,299 | 2,329 | 1,771 | 1,299 | 125,392 |
| Chevrolet | 41,173 | 31,733 | 37,919 | 39,887 | 1,484,551 |
| Oldsmobile | 11,218 | 8,608 | 8,685 | 7,688 | 392,090 |
| Pontiac | 9,313 | 7,196 | 7,765 | 7,439 | 305,578 |
| Total—General Motors Corp. | 78,942 | 59,324 | 66,196 | 64,626 | 2,788,729 |
| Packard | 0 | 0 | 0 | 0 | 13,289 |
| Studebaker | 1,820 | 1,433 | 2,841 | 2,639 | 74,889 |
| Total—Studebaker—Packard | 1,820 | 1,433 | 2,841 | 2,639 | 88,178 |
| Checker Cab | 95 | 22 | 121 | 105 | 3,643 |
| Total—Passenger Cars | 159,746 | 118,470 | 135,973 | 132,215 | 5,224,968 |
| **TRUCK PRODUCTION** | | | | | |
| Available | 6 | 5 | 4 | 3 | 349 |
| Chevrolet | 7,823 | 5,373 | 6,973 | 7,194 | 325,053 |
| G. M. C. | 1,940 | 1,155 | 1,862 | 1,893 | 84,944 |
| Diamond T | 77 | 64 | 84 | 104 | 4,778 |
| Divco | 80 | 48 | 60 | 8 | 3,289 |
| Dodge and Fargo | 2,686 | 1,626 | 1,500 | 1,731 | 83,724 |
| Ford | 6,183 | 4,668 | 5,606 | 5,348 | 279,723 |
| International | 3,314 | 2,295 | 2,455 | 2,809 | 125,233 |
| Mack | 351 | 273 | 386 | 287 | 16,758 |
| Reo | 50 | 51 | 55 | 89 | 3,566 |
| Studebaker | 455 | 282 | 345 | 382 | 13,888 |
| White | 310 | 238 | 307 | 284 | 16,234 |
| Willys | 1,795 | 1,182 | 1,564 | 1,436 | 58,432 |
| Other Trucks | 113 | 93 | 151 | 89 | 7,248 |
| Total—Trucks | 25,183 | 17,353 | 21,352 | 21,680 | 1,023,260 |
| Buses | 36 | 34 | 39 | 69 | 3,853 |
| Total—Motor Vehicles | 184,965 | 135,857 | 157,364 | 153,973 | 6,252,081 |

* Prior to week ending Sept. 1, 1956, Rambler production was included with Nash and Hudson.

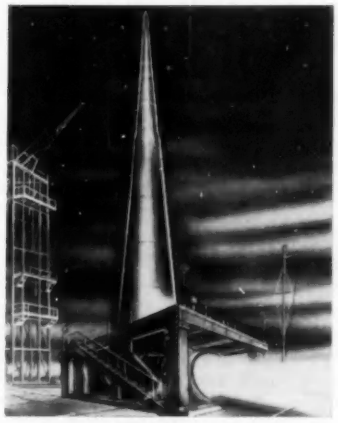
### C-W Exploring German Diesel For Use In Trucks And Buses

Curtiss-Wright still is actively negotiating with Daimler-Benz for all its products for distribution through Studebaker-Packard outlets. The line could include not only cars and trucks, but Diesel engines and fuel injection systems. Curtiss-Wright is doing considerable exploratory work at its Utica plant involving the German Diesel for bus and possibly truck use.

### Fruehauf Gets Order For Gas Tank-Trailers

A $990,000 contract for production of 137 gasoline tank-trailers has been awarded to Fruehauf Trailer Co. by the Ordnance Tank-Automotive Command. Scheduled for delivery beginning in January, the trailers, called "refuelers," will be built at Fruehauf's plant in Fort Wayne, Ind.

# AND AVIATION INDUSTRIES



**SATELLITE LAUNCHER**

*Firing and launching platform for the Vanguard rocket was designed, built, and installed by Loewy-Hydropress Div. of Baldwin-Lima-Hamilton Corp. Martin Co. is prime contractor for the three-stage rocket, which will attempt to place the world's first man-made satellite in its orbit around the earth. Vapor blast at right of picture is stream of exhaust gases. In background is gantry used to place the rocket on the platform.*

### *Eaton Earmarks $3.5 Million For Expanding Axle Division*

Eaton Manufacturing Co. will spend $3.5 million on a new expansion and realignment program for its Axle Div. in Cleveland. The $3.5 million program includes construction of a new 135,000 sq ft plant adjoining the main plant and modernization of existing facilities.

### *Willys Gets Second Contract For Army's "Mechanical Mule"*

Willys Motors has received its second contract for production of the Army's new lightweight tactical vehicle, the "Mechanical Mule." Value of the latest contract is $1.4 million. Designed primarily as a cargo carrier, the Mule has the lowest silhouette of any military vehicle and is light enough to be carried by a helicopter or dropped from an airplane by parachute. Willys earlier received a $3.5 million contract for the same vehicle.

## AI TABLOID

Du Pont Co. has developed a new plastic material called Delrin acetal resin.

* * *

Timken Roller Bearing Co. will begin construction of a new $500,000 metallurgical research laboratory in the spring of 1957. . . . Walter Motor Truck Co. will erect a truck body plant at Voorheesville, N. Y.

* * *

Autocar Div. of White Motor Co. has turned out more than 4000 trucks and tractors in its Exton, Pa., plant.

* * *

Bendix Aviation Corp. has formed a Systems Div. at Ann Arbor, Mich., to concentrate on weapons systems requirements of the Dept. of Defense.

* * *

International Harvester Co. has expanded its all-wheel-drive truck line with the addition of four six-wheel-drive models and two four-wheel-drive models.

* * *

Fruehauf Trailer Co. has set up a national fleet sales office in Chicago.

* * *

Cummins Engine Co., Inc., has established a plant for the manufacture of Diesel engines at Shotts, Lanarkshire, Scotland. . . . Deere & Co. is building a new manufacturing plant at Monterrey, Mex.

* * *

Piasecki Aircraft Corp. has acquired the plant, machinery, and other physical assets of the Aircraft Division of Bellanca Corp. Reported purchase price for the facilities at New Castle, Del., was $1.325 million.

* * *

Du Pont Co. has published a new booklet titled "The Story of Business: Large and Small," that traces the growth of the business community.

Youngstown Sheet and Tube Co. is consolidating its Continental Supply Co. and Emsco Manufacturing Co. divisions into one division to be known as Continental-Emsco Co.

* * *

Materiai Handling Institute, Inc., predicts 1957 sales of material handling equipment will be 10 per cent higher than in 1956.

* * *

Renault has put into operation its latest new automated factory at Flins, France, and plans to make a strong bid for a larger share of the U. S. foreign car market in 1957.

* * *

Divco Corp. is now known as the Divco Truck Div. of Divco-Wayne Corp.

* * *

Tractor & Implement Div. of Ford Motor Co. has set up a new parts depot at Des Moines, Ia.

* * *

Fairchild Engine & Airplane Corp. is planning to acquire Jonco Aircraft Corp. . . . Aerojet-General Corp. has purchased Ordnance Engineering Corp.

* * *

Wayne Works, Inc., has combined A. J. Miller Co. and Meteor Motor Car Co.

* * *

Transcendental Aircraft Corp. has completed fabrication and begun pre-flight studies of its TAC Model 2 convertiplane.

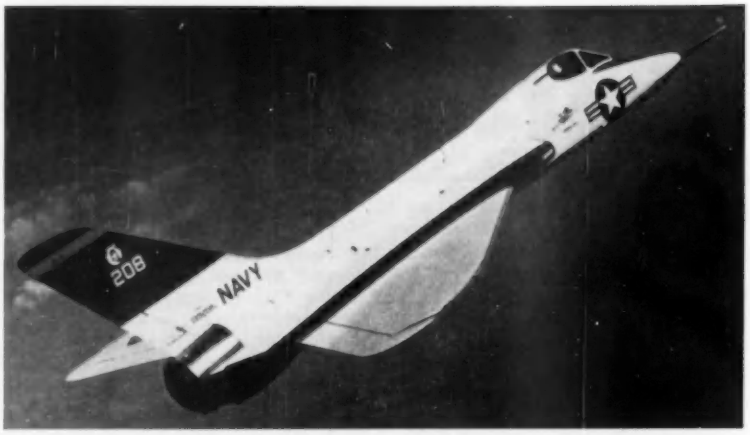
* * *

Fredric Flader, Inc., will become a division of Eaton Mfg. Co. on Jan. 1.

* * *

General Electric Co. may increase its capital expenditures over the next three years $100 million to $200 million over a previously disclosed $500 million figure.

# News of the AUTOMOTIVE




**JET CARRIER PLANE SOARS TOWARD THE HEAVENS**

*Zooming skyward like a meteor is the new Navy supersonic Douglas F5D Skylancer. First photo to be released of the all-weather, high-altitude performer reveals that it has a wafer-thin, modified delta wing which rakes back from a long, slim fuselage. It is powered by an advanced version of the Pratt & Whitney J-57 turbojet engine.*

### Mercury's Turnpike Cruisers Priced at $3415 and $3500

Mercury's new line of cars, the Turnpike Cruiser, will carry price tags ranging from $305 to $390 above the division's present highest priced Montclair series of cars. To be offered in January, the new models will have a suggested list price of $3415 for the two-door model and $3500 for the four-door model. Practically all equipment offered on other models as options will be standard on the Turnpike Cruiser, including all power assist items and automatic transmission.

### S-P Loses $49 Million During First 9 Months

Although losses by Studebaker-Packard in the third quarter were reduced by approximately $5 million under the similar three months of last year, the company sustained a net loss of $49 million during the first nine months compared with $28.9 million in the same nine months of 1955. A large part of the loss was attributed to costs involved in closing down Packard's Detroit operation and the consolidation of automobile and truck activities in South Bend following a management agreement with Curtiss-Wright Corp.

Actual operating losses in the first half of this year, before special charges and certain reserves, totalled $35.4 million. The loss in the third quarter totalled $14.1 million compared with $19.3 million in the like 1955 quarter.

### Chevrolet Fuel Injection Carries $485 Price Tag

Chevrolet's price of about $485 for fuel injection, which is available on the Corvette engine, indicates that the market will be a limited one. So far very few cars have been equipped with it, but production is picking up.

Actually, Chevrolet will offer two engines with fuel injection — one a high performance unit for racing and for a limited number of buyers who want top performance, and the other a "street" model for buyers wanting fuel injection but not necessarily interested in maximum performance.

Both engines are 283 cu in. but the top engine generates 283 hp, has a higher compression ratio and is equipped with mechanical lifters; the "street" engine gives 250 hp, has a lower compression ratio, and is equipped with hydraulic lifters.

### Dodge Survey Points Up Rise In Car "Options"

If a recent survey by Dodge Div. is any indication, sales of optional equipment on automobiles can be expected to make further gains next year. The survey is the first covering 1957 models. (An industrywide comparison of optional equipment sales for 1955 and 1956 model years was published in the Sept. 15 issue of AUTOMOTIVE INDUSTRIES.)

With the exception of tinted glass and engine power packs, sales of most options are decidedly ahead of the 1956 model year, the Dodge survey shows. Dodge does not explain why the popularity of tinted glass has diminished so greatly. The division currently is installing tinted glass on only 20 per cent of its total production, compared with nearly 38 per cent in 1955. The obvious reason for the drop in engine power pack sales is the introduction of special engines with higher horsepower on certain 1957 models.

Percentage figures on Dodge equipment items:

| | 1956 | 1957 |
|---|---|---|
| Power Steering | 22.5% | 34.3% |
| Power Brakes | 17.6 | 21.9 |
| Radio | 47.2 | 61.9 |
| Heater | 94.8 | 97.2 |
| Windshield Washer | 21.4 | 38. |
| Back-up Lights | 62.6 | 92. |
| Whitewall Tires | 60.2 | 78. |
| Tinted Glass | 23.7 | 20. |
| Engine Power Package | 6.8 | 2.1 |
| Overdrive | 1.4 | Not offered |
| Torque Flite Transmission (3-speed) | Not offered | 60.5 |
| Standard Transmission | 8.3 | 4.4 |

### Ford Adds Lower Priced Sutton Air Conditioner

Ford Div. of Ford Motor Co. has confirmed that it will market a new lower cost air conditioning unit manufactured by O. H. Sutton Corp., of Wichita. The air conditioner will be installed by Ford dealers.

Ford will continue to offer its own version of a combined heating air conditioning unit known as Selectaire, which also is dealer-installed. The system is assembled by Ford from components supplied by five vendors and is shipped to dealers for local installation.

# AND AVIATION INDUSTRIES

### Roche, Seaton, De Lorenzo Named GM Vice Presidents

General Motors has appointed new vice-presidents to succeed three of the corporation's veteran executives who will retire Dec. 31. They are James M. Roche, who will succeed Don E. Ahrens as general manager of the Cadillac Division; Louis G. Seaton, director of personnel staff, a post held by Harry W. Anderson; and Anthony G. De Lorenzo, director of public relations, to succeed Paul Garrett. In addition, William K. Whiteford, president of Gulf Oil Corp., was elected a member of GM's board of directors.

Roche joined GM in 1927 and has been general sales manager of Cadillac since 1950. Seaton has been with the corporation since 1928, working in various phases of personnel work. He served as GM's representative on hearings before the National War Labor Board on negotiations with all of the unions with which GM has contracts. A former newspaperman, De Lorenzo joined GM in 1949 and was named director of public relations earlier this year.

### S-P Reports Heavy Orders For No-Spin Differential

The non-slip differential, introduced by Packard and adopted by Studebaker on its 1957 cars, is being installed on a sizeable portion of Studebaker cars ordered by dealers, Studebaker-Packard reports. Fifty-two per cent of the car orders scheduled for delivery in December call for the differential, or about three times the original anticipated total. In addition, S-P noted, more than half of the half-ton trucks being ordered are being equipped with the special axle.

### Ford Rushes Plans To Complete Two New Assembly Facilities

Confident that the current upswing in new car sales will continue for some time, Ford Div. is stepping up its plans for the completion of two more assembly plants. They include a 1.75 million sq ft unit at Lorain, Ohio, for which ground was broken last month, and its new Claycomo, Mo., facility, which is being converted from aircraft production to automobile assembly.

While the Lorain plant is not expected to be completed for at least another year, automobile production at the Claycomo unit is scheduled to start in January under the accelerated program. Built in 1951, the Claycomo plant will be the most modern unit in the division's network of 15 plants. It will replace the division's old Kansas City plant, whose facilities have become outmoded. When in full operation the plant will employ 25 per cent more persons than the Kansas City unit.

**AUSTIN-HEALEY ADOPTS SIX-CYLINDER POWER PLANT**

*The more powerful Austin-Healey for 1957 has a six-cylinder engine of 161 cu in. displacement and is rated at 102 bhp at 4600 rpm. The chassis is modified to take the longer engine, and wheelbase has been extended by two in. Aside from the front grille and air intake on the hood, appearance is similar to the previous four-cylinder, 90-hp model, although the body is wider and has another rear seat.*

### Borg-Warner to Build New Plant in Indiana

Borg-Warner Corp. will start construction next spring of a modern plant at Auburn, Ind., for its Warner Automotive Parts Div. Production operations that currently are housed in several of the older buildings there will be consolidated in the new 1 2,-000 sq ft plant by next fall.

Considerable new equipment for the manufacture of new products will be installed in the plant. With increased efficiency of manufacturing and materials handling operations, production of additional products and expansion of present manufacturing volume will be possible.

### Chevrolet Gives Details About New Engineering Hub

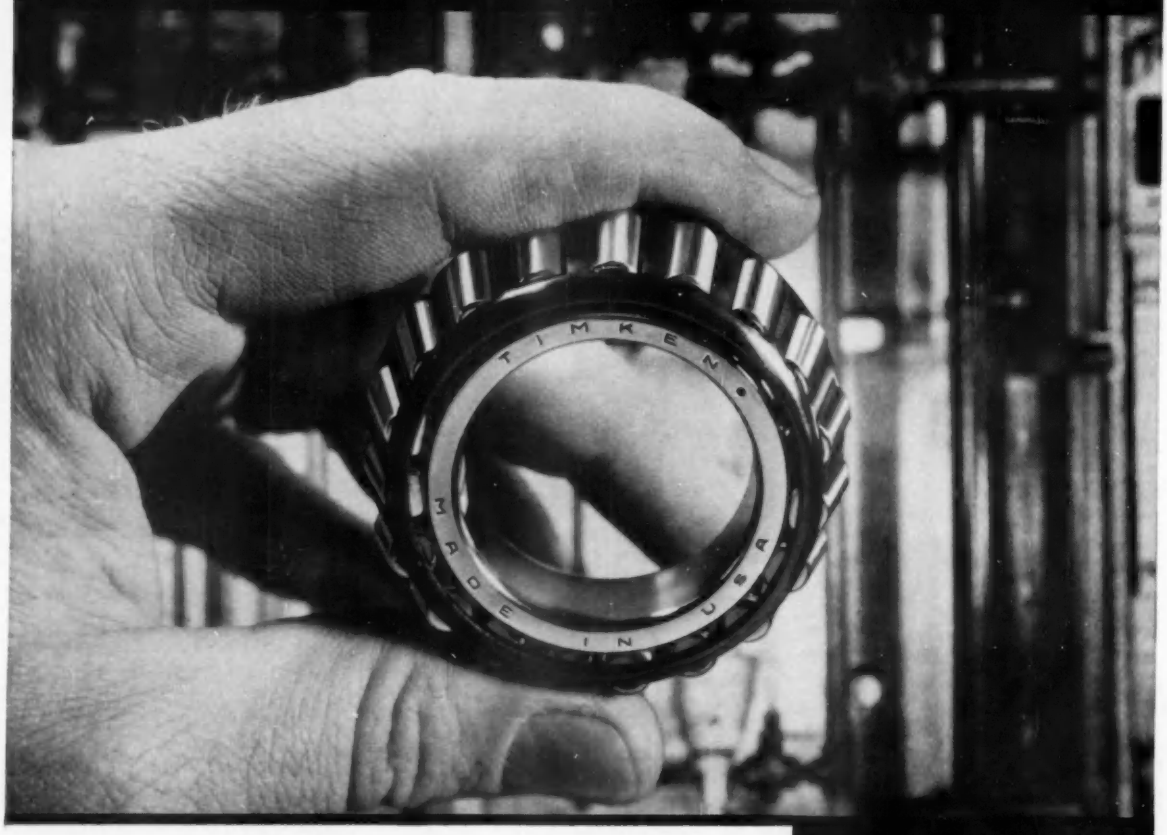
Chevrolet's new engineering center, unveiled officially this month, contains virtually every type of facility and equipment required in the designing, testing and building of experimental and prototype cars and trucks. It even includes a "torture chamber" with 6000 pieces of testing equipment and instrumentation.

Located on a 54-acre tract adjacent to GM's Technical Center, north of Detroit, the center consists of three interconnected structures, including a one-story experimental shop, a test laboratory and a four-floor office building. The shop and laboratory contain 18 dynamometer rooms and presses with capacities ranging up to 2500 tons.

Three years in the making, the 640,000 sq ft center will house more than 2000 engineers and technicians who make up a majority of the division's engineering staff. It also will serve as the headquarters for Chevrolet's chief engineer, executive assistant chief engineer, and a director of research and development.

*Meeting the big change in cars with the big change in bearings:*

# TIMKEN® and The Moto-Mated Way




## New TIMKEN Moto-Mated bearings are smaller, permit more compact designs

FROM a revolutionary new kind of bearing plant comes a new breed of bearings—the product of an entirely new concept in bearing design, production and supply *mated* to the new needs of the auto industry. It's the Timken Company's Moto-Mated Way.

The new Timken® Moto-Mated tapered roller bearings are smaller, permitting more compact car designs and savings in lubricant. They're lighter, cutting unsprung weight to provide a more comfortable ride. In front wheels, for example, they cost 14.6% less than previous designs. They're lower cost because they're made in a new kind of plant that uses advanced production methods new to the bearing industry. They take the increased loads of today's power cars in stride by packing maximum capacity into minimum space. And they're *available* in almost unlimited supply.

By adopting new standardized Timken Moto-Mated bearing sizes for front wheels, the auto industry has helped make present savings possible. Additional savings will result when the new Moto-Mated sizes are adopted for rear wheels, pinions and differentials.

Whether your immediate concern is automotive design, production or purchasing, you stand to benefit from Timken and the Moto-Mated Way. Our engineers are ready to help you adapt your designs to the new Timken Moto-Mated bearings. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable: "TIMROSCO".

QUALITY, SERVICE, PUBLIC ACCEPTANCE MAKE

**TIMKEN**

TRADE MARK REG. U.S. PAT. OFF.

*TAPERED ROLLER BEARINGS*

YOUR NO. 1 BEARING VALUE

# Men in the News

*Bullard Co.—C. J. Wilson has been named director of manufacturing.*

Twin Disc Clutch Co.—**R. A. Harmon** has been appointed manager of district sales, and **Paul J. Demet** has been made dealer sales supervisor.

Willys Motors, Inc., Central Div.—**K. S. Moyer** has become manager.

Buick Motor Div., General Motors Corp.—**Howard C. Potts** is now superintendent of the final assembly plant.

Hannifin Corp.—The following divisional sales managers have been named: **Robert G. Broberg**, for the Air and Hydraulic Power Cylinder Div.; **William C. Thompson**, for the Air Valve Div.; and **Arnold W. Blackshaw**, for the Machinery Div., air and hydraulic presses and portable hydraulic power tools.

Chrysler Corp., Export Div.—**Edward W. Salley** is now vice-president of finance.

Yale Materials Handling Div., Yale & Towne Manufacturing Co.—**S. Wilson Clark** has been promoted to manager of export sales, and **Louis W. Jander** has been made eastern regional sales manager.

Minnesota Mining & Manufacturing Co., Coated Abrasives Div.—**William E. Marsden** has become manager of automotive trades.

General Motors Corp. — **Roy P. Trowbridge** was made director of the Engineering Standards Section.

Lamson Mobilift Corp. — **Karl C. Schmedicke** is now manager of manufacturing.

*Lindberg Engineering Co.—John R. Gorey was made sales promotion manager.*

*Cleveland Worm & Gear Co.—John R. Dingle and Lee O. Witzenberg have been appointed vice-president in charge of manufacturing and vice-president in charge of sales, respectively, for the company and its affiliate, The Farval Corp.*

AC Spark Plug Div., General Motors Corp.—**Clifford L. Johnson** has been appointed director of production engineering.

General Tire & Rubber Co., Industrial Products Div.—**Frank T. Downs** is now sales manager.

Armstrong Cork Co. — **Clyde O. Hess** has been named manager of Public Information in the Public Relations Dept.

*Cleveland Worm & Gear Co. — Sidney L. Eastman has been named vice-president in charge of engineering.*

Bendix Aviation Corp., Red Bank Div.—**William Sendell** is now general products production manager.

Clevite Harris Products, Inc.—**Edward T. King** was chosen director of purchases.

B. F. Goodrich Tire Co.—**W. F. Billingsley** has been named technical director.

General Electric Co.—**J. S. Gillespie** has been named manager of engineering for the Metallurgical Products Dept.

Sperry Western, Inc. — **Robert B. Manning** was elected president.

Chrysler Corp.—**Harry R. Bentley** has been appointed manager of the Trenton, Mich., plant.

*Borg-Warner Corp. — Henry M. Haase was elected vice-president in charge of engineering and research.*

Youngstown Sheet and Tube Co.—**J. L. Mauthe** has been elected chairman of the board, and **A. S. Glossbrenner** succeeds him as president. **Walter E. Watson** has been named vice-chairman of the board; **William H. Yeckley**, vice-president of operations; and **Frederick M. Mayer**, vice-president.

### Necrology

**Keith R. Rodney**, 81, a director of Edgcomb Steel and Aluminum Corp., died Nov. 24, at Hillside, N. J.

**J. J. Hanney**, 58, of Grand Rapids, Mich., sales representative of Metal & Thermit Corp., died Nov. 24, while on a hunting trip.

**Leland H. Shepherd**, 66, veteran manager of Goodyear Tire & Rubber Co.'s Southern tire sales division, died Nov. 22, at Atlanta, Ga.

**F. W. Swanson, Sr.**, 71, founder and recently retired chairman of the board of Globe Hoist Co., died Nov. 28, at Des Moines, Ia.

**John E. Snowberger**, 63, former works manager of Willys Motors, Inc., died Nov. 21, at Toledo, O.

**Charles E. Maloney**, 63, vice-president of General Motors Acceptance Corp., died Nov. 16, at New York, N. Y.

**Robert M. Reindollar**, 62, past president of the American Road Builders Association, died Nov. 17, at Baltimore, Md.

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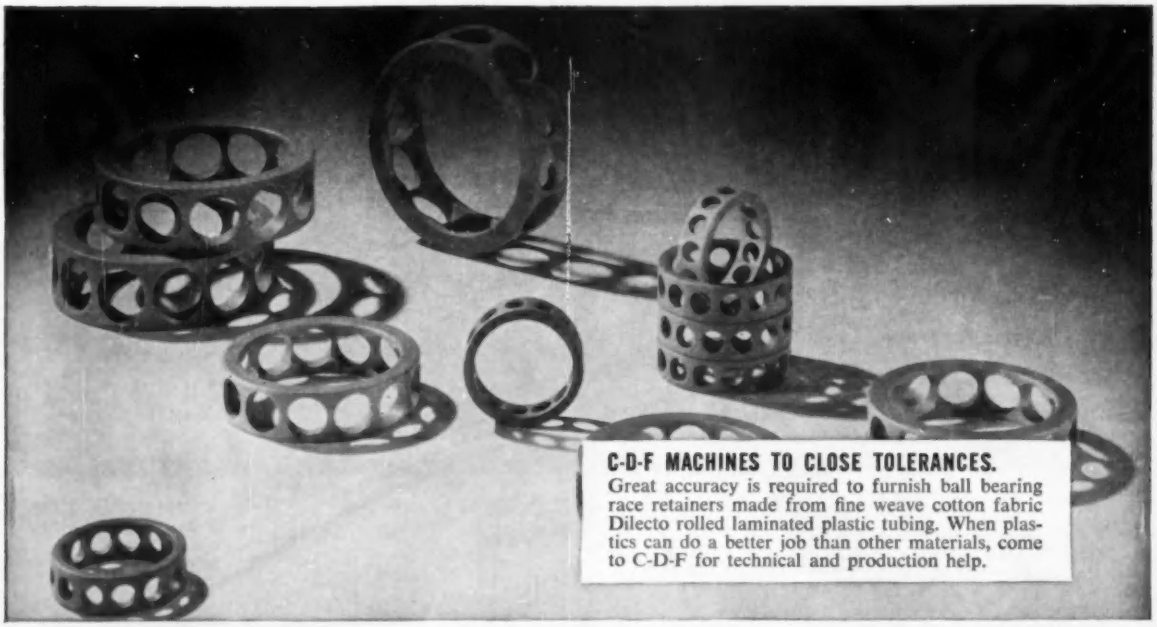
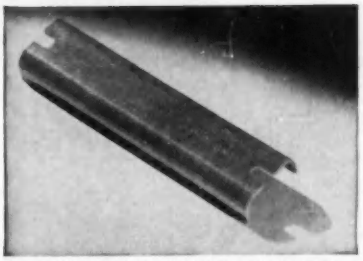
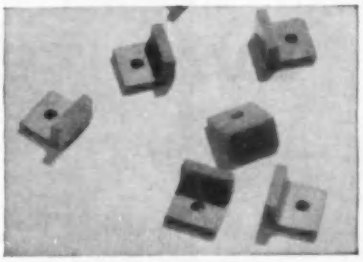


**C-D-F MACHINES TO CLOSE TOLERANCES.** Great accuracy is required to furnish ball bearing race retainers made from fine weave cotton fabric Dilecto rolled laminated plastic tubing. When plastics can do a better job than other materials, come to C-D-F for technical and production help.



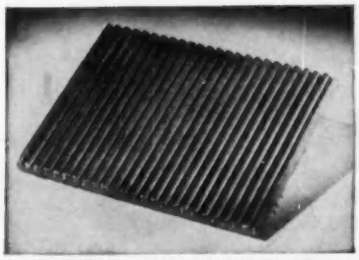
**C-D-F PIONEERED IN POST-FORMING** of laminated plastics. This technique gives you stronger, more versatile insulating parts with lower costs. This aircraft channel strip is an example of simple post-forming.



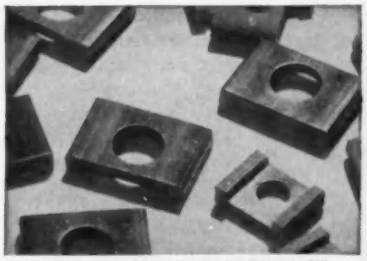
**C-D-F DOES THE UNUSUAL.** These rubbing blocks are made from fine-weave cotton cloth Dilecto molded *tubing* that has been pierced and cut. The part gains in mechanical strength — the product gets longer service life.

**C-D-F SPECIALIZES IN AUTOMATIC SCREW MACHINING** of plastic components. These breaker arm bushings are made from Dilecto paper base rolled tubing on high speed machines by men who know and use cost saving methods.

# Yes, C-D-F is a big reliable source for fabricated plastics!



**C-D-F SERVES MANY INDUSTRIES** with fabricated specialties. A great amount is concentrated in the automotive and allied fields. This aircraft part has a corrugated surface on a strong woven asbestos laminated base.



**C-D-F IS A PUNCHING SPECIALIST** on these starter solenoid insulators. This is XX-26 Dilecto molded channel strip, pierced and punched to length. Special C-D-F punching grades give you lower costs, faster assembly, fewer rejects.

**C-D-F COMES UP WITH THE ANSWERS** to insulating problems. These unique snap-in grommets are easy to insert, spring out and hold tight. Write for samples. The chances are that C-D-F is already making the answer to your problem.

See our general catalog in Sweet's Design File for more technical data, the address and telephone number of your nearest C-D-F sales engineer. Also, write for detailed information, samples, or send us your print for quotation.

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**CONTINENTAL-DIAMOND FIBRE DIVISION OF THE BUDD COMPANY, INC.**

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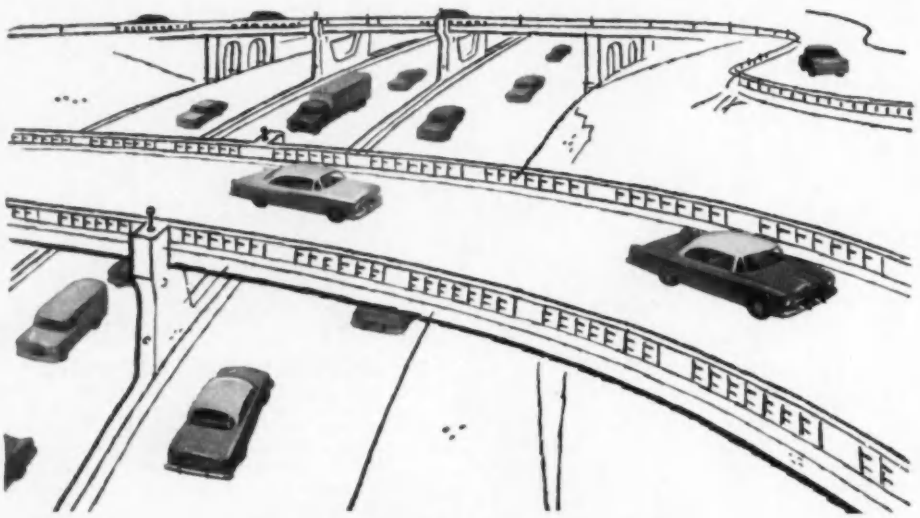

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Every day Evanite battery separators are proving their worth in severe, on-the-road service under all weather conditions. And every day these tough, durable separators are helping deliver the high performance demanded of batteries used in today's modern cars.

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Ask your battery maker to investigate Evanite today. Urge him to write EVANS PRODUCTS COMPANY, Dept. P-12, Plymouth, Mich.

***Plant:*** Coos Bay, Oregon. ***Sales Offices:*** Plymouth, Mich.; Coos Bay, Ore.; New York, N.Y.; Chicago, Ill.; Tampa, Fla.

**EVANITE**

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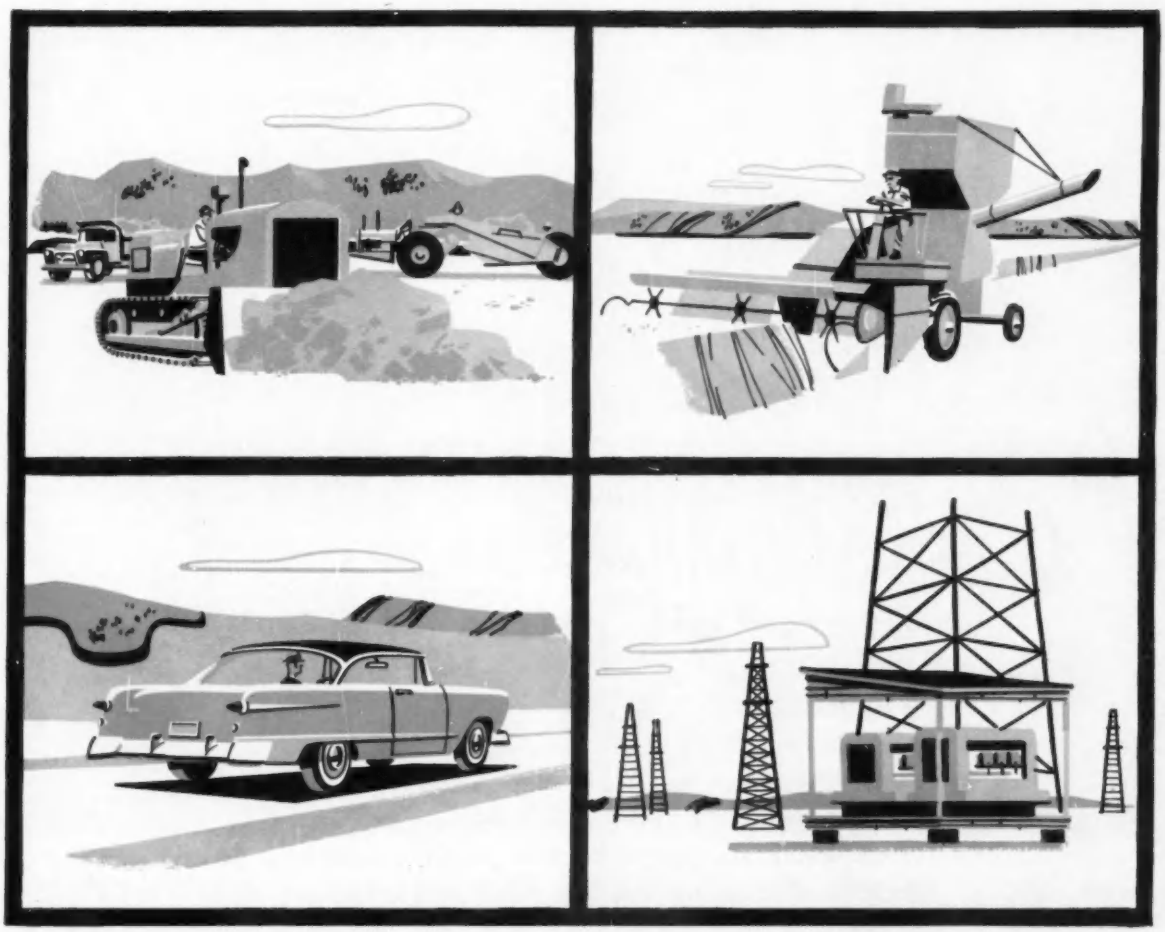
**EVANS PRODUCTS COMPANY also produces: truck and bus heaters; Evaneer fir plywood; railroad loading equipment; Evans bicycles and velocipedes**



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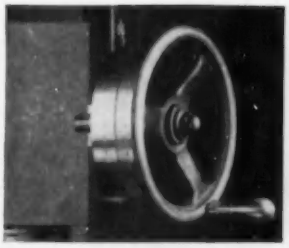
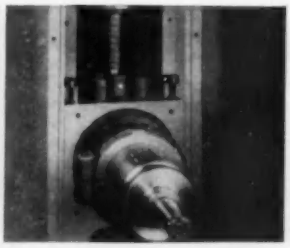
# Accurate grinding for small parts

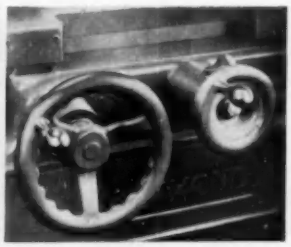
■ The Hammond No. 2, 6″ x 18″, Surface Grinder is a precision tool room machine for use on the most accurate gauge and tool work. The standard spindle is direct motor driven and is mounted on precision preloaded ball bearing. Total vertical adjustment is 10¾″. In and out movement of table is 6½″ with a longitudinal travel of 18″.



**ACCURATE SPINDLE ADJUSTMENT**—Standard vertical adjustment of spindle through handwheel is .0005″. With Vernier attachment, spindle can be raised accurately to .00005″.



**SOLIDLY SUPPORTED SPINDLE CARRIER**—Spindle carrier is moved vertically on double dovetail ways with adjustable tapered gibs.



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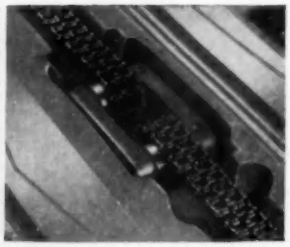

**SMOOTH ROLLER CHAIN TABLE DRIVE**—Remarkably smooth finish on work without chatter marks frequently found when table is moved by conventional means through rack and pinion.

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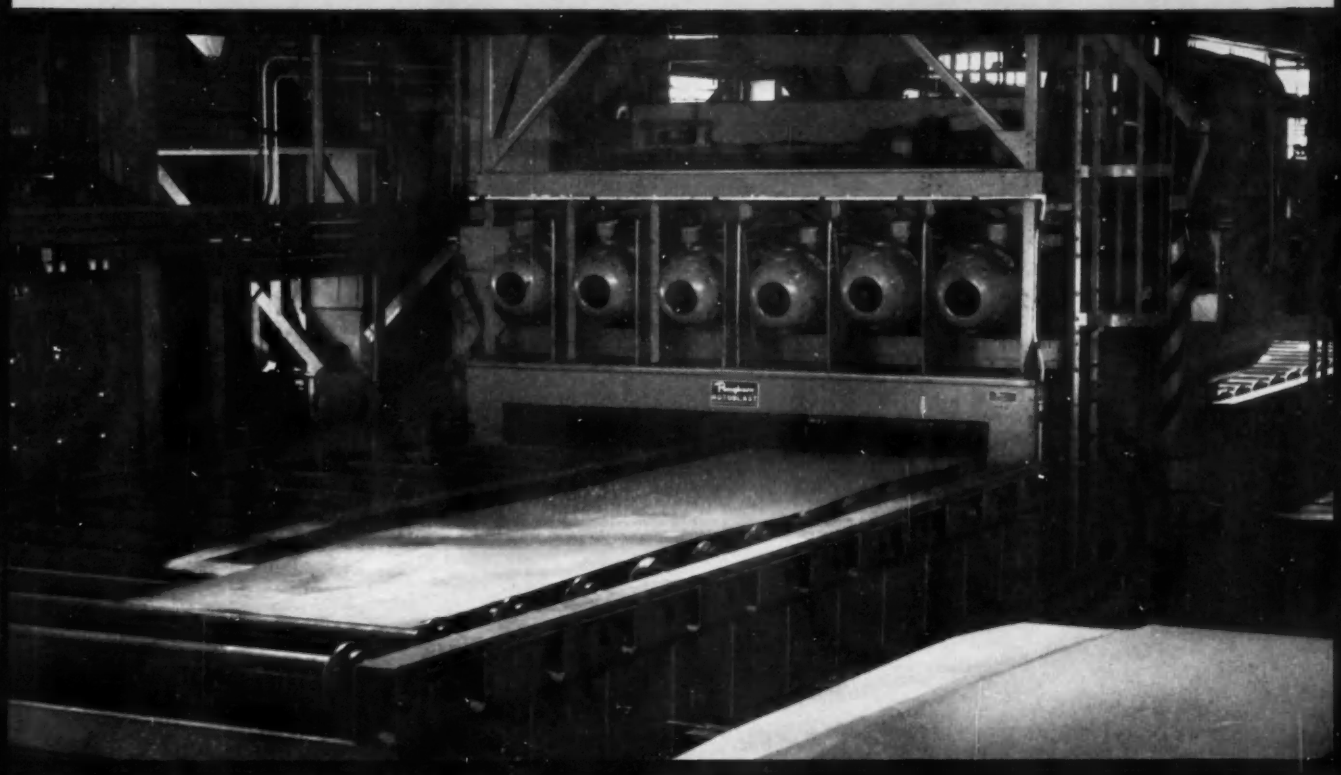
# FOOTBURT

## SURFACE GRINDING

# Descale steel sheets, plates, coils



No more scale breaking or pickling! No more acid disposal problems! Pangborn Rotoblast Descaling Machines descale steel sheets, plates and coils, and they operate at big savings over pickling costs!

How? They work quickly. They clean thoroughly. They're a one-man operation. Unlike acid baths, they can be located near your production, cutting handling costs. And they save floor space, require much less room than vats. Available in a variety of models, Pangborn Rotoblast Descaling Machines handle steel sheets, plates and coils of any thickness, width and length. If you want to cut descaling costs to the bone, investigate Pangborn Descaling Machines!

For complete information, send for Bulletin 224. Write: PANGBORN CORPORATION, 3900 Pangborn Blvd., Hagerstown, Maryland.

*U. S. Pat. #2184926 (other patents pending)

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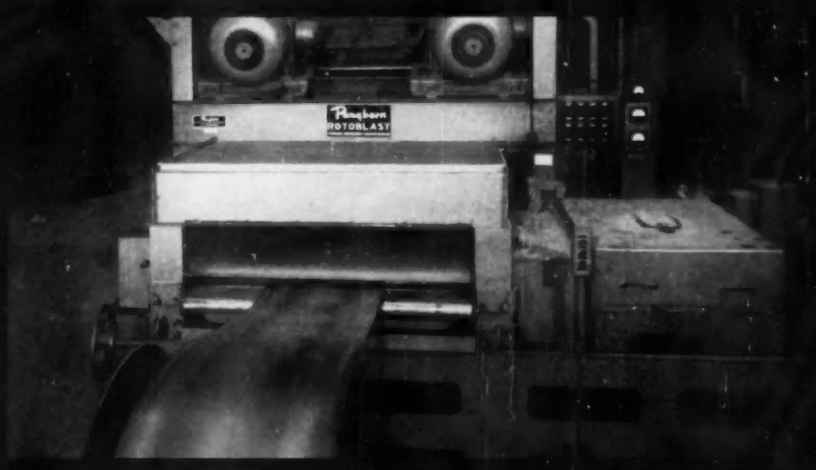


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Rotoblast Tables & Table-Rooms

Special Blast Rooms & Cabinets

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# 100 Per Cent Increase in Use of

ALUMINUM has really broken the barrier on trim applications for the 1957 passenger car model year. Figures from the aluminum makers indicate at least a 100 per cent increase in the use of aluminum trim.

This, together with other new uses for '57 cars, reports Kaiser Aluminum, has brought the average up to 40 lb or more of aluminum per car. Reynolds Metals indicates that the average is 45 lb per car, or some 10 lb higher than last year's average. Chevrolet alone, for example, uses 300 per cent more than in any previous year, according to Reynolds. The other big aluminum producer, Alcoa, seems to believe that the national average will be somewhere between the 40 and 45 figure. The firm is holding off on a definite answer until it has completed its passenger car aluminum survey.

Industry-wide style trends favor further increased use of aluminum, according to Kaiser; and this factor

## By Thomas Mac New

overshadows in importance the actual gain in pounds of aluminum per car. These trends, clearly evident in the 1957 models, include a lower silhouette, sculptured modeling, wings or tail fin shapes that provide an impression of speed, and a more subtle playing of textures and finishes to relieve the hard, shell-like exteriors of earlier models.

Of the trends exhibited in the 1957 cars, and likely to be emphasized in future models, sculpturing, the aluminum firms feel, is perhaps most favorable to the decorative use of aluminum. Sculpturing guides the eye along the length of the car, creating an illusion of sleek lowness.

Aluminum sculpturing is featured on the 1957 Ford and Mercury, and aluminum side-plating on the Chevrolet and Hudson. Ford has a gold anodized aluminum strip running from the front fender back to the rear flared fin. On the Mercury a long, deep concavity is set off with gold anodized, embossed aluminum. Chevrolet features a strip in natural color tapering sharply upward from an inch in width to 14 in. Hudson has an arrow-headed concavity set off with natural colored sheet.

Aluminum grille work can be seen on many 1957 cars, including Chevrolet, Plymouth, DeSoto, Chrysler and Cadillac. Chevrolet features a grille of rectangular perforated alloy 3003 sheet; Plymouth and Chrysler use roll-formed 5357 aluminum sheet, and Cadillac features an egg-crate extrusion of 6063 alloy. The units run from one to 15 lb per grille. The head-lamp "doors" on the 1957 Plymouth are made of deep drawn sheet of soft 5357 alloy.

Aluminum bumper guards are also beginning to make their appearance. The advantage here, in addition to corrosion resistance, lightweight, and beauty, is that aluminum can be cast economically in complex shapes.

Other, less functional, but still important uses on the exterior of 1957 models include the stamped aluminum sheet covering the spare wheel and tire assembly on the optional rear deck of the new Chrysler Imperial.

There is also a widespread use of aluminum for emblems and insignias, usually either high purity metal or 5357 alloy. The parts are formed by a series of combined stamping and forging operations through progressive dies, in which the metal "flows" cold. The result is a strong, sharply delineated letter or figure.

Interior trim, which has been largely confined to scuff plates and instrument paneling, also shows wider use of aluminum on the 1957 models. Seat shields on the new Buick and Oldsmobile are smooth finish aluminum stampings, bright dip anodized, with a medallion affixed in the center. General Motors' hardtops are using roof bows and garnish molding of aluminum to simulate the ribbing that used to support the convertible top.

Window frames are made of extruded aluminum shapes on the 1957 DeSoto, Chrysler, and Imperial, amplifying a design trend begun by American Motors several years ago.

All of the current exterior and interior usages of aluminum—side-plating, grille work, headlamp doors, bumpers, ornamentation, seat shields and door frames—represent an addition to aluminum usages established in earlier models.

An effect of the new 14 in. wheel, used by some car makers, is a reduction in the amount of cooling surface for the brake drums. This provides aluminum with a major opportunity because of its heat conducting properties. A single die-cast aluminum wheel, recently developed by Kaiser Aluminum, is currently undergoing road evaluation after successfully passing laboratory tests. It not only dissipates heat rapidly, but cuts unsprung weight.

Some interesting research is being carried out by certain aluminum companies on integral aluminum wheel and brake drum assemblies to lighten up on unsprung weight and provide better braking with smaller diameter drums. For the brake drums, iron,

& Continuous-Flo Barrel & Table-Rooms & Cabinets Control Equipment
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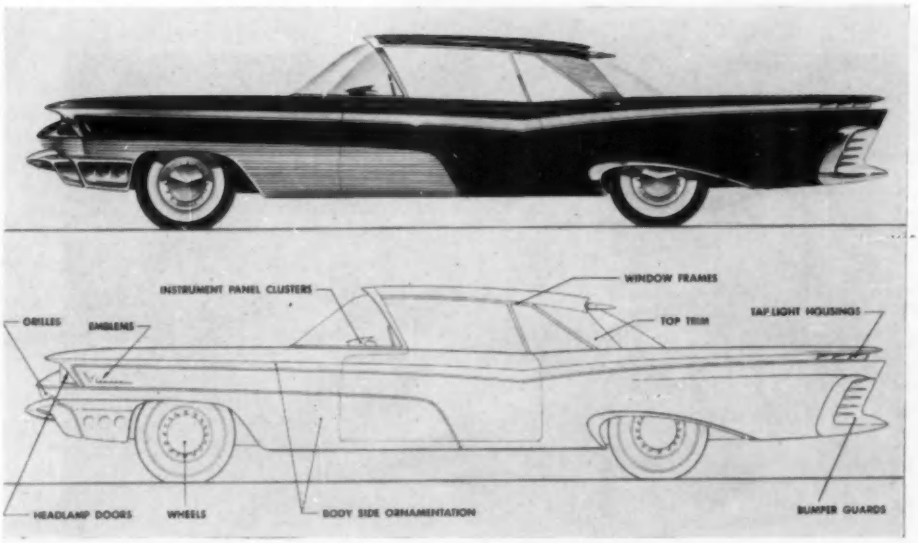
# Aluminum for Automobile Trim




***This sketch by the industrial design department, Kaiser Aluminum & Chemical Corp., brings together in a "composite" passenger car all the decorative, exterior applications of aluminum being used by the car makers in their various 1957 models. The rapidly increasing use of aluminum, with its high resistance to corrosion and wide variety of attractive finishes, is one of the most significant style trends in the automotive industry.***

sprayed on the ID of the drum, is used for the lining contact surface. This is still in the experimental stages.

Aluminum has penetrated deeply in the optional equipment market: power steering, power brakes, automatic transmissions, and more recently, air conditioners.

Large central castings are used in power brake and steering units; castings and impact extrusions are used for many parts of automatic transmissions.

Biggest transmission news, regarding aluminum, is the new Chevrolet Turboglide. This uses the largest single cast aluminum part, an integral housing for the converter and transmission, in the industry. It also makes use of an aluminum extension bolted to the main assembly. Another interesting fact is that Chrysler Corporation's Torque-Flite uses 35 lb of aluminum or just about what the average car used last year. It is readily discernible then, since about 75 per cent of the cars are equipped with automatic transmissions, that the aluminum weight per car will be well above the 1956 level.

Then, too, power steering units take 10 lb of aluminum. With consumer acceptance running high, that unit will give a boost to the national average.

Looking beyond 1957, it would appear that aluminum will play an increasingly important role in passenger cars of the future. Certainly the current style trends indicate a greater emphasis on automotive designs which favor this light and versatile metal. Experts seem to think that the average car will use 150 lb or more of aluminum by 1960.

The lower body silhouette, for example, points to the day when door construction will have to extend into the roof section. A step in this direction is the announced plan by Packard to incorporate roof doors in its Predictor model. In this design, the doors are made of tongue-and-groove aluminum extrusions that slide back into the roof itself

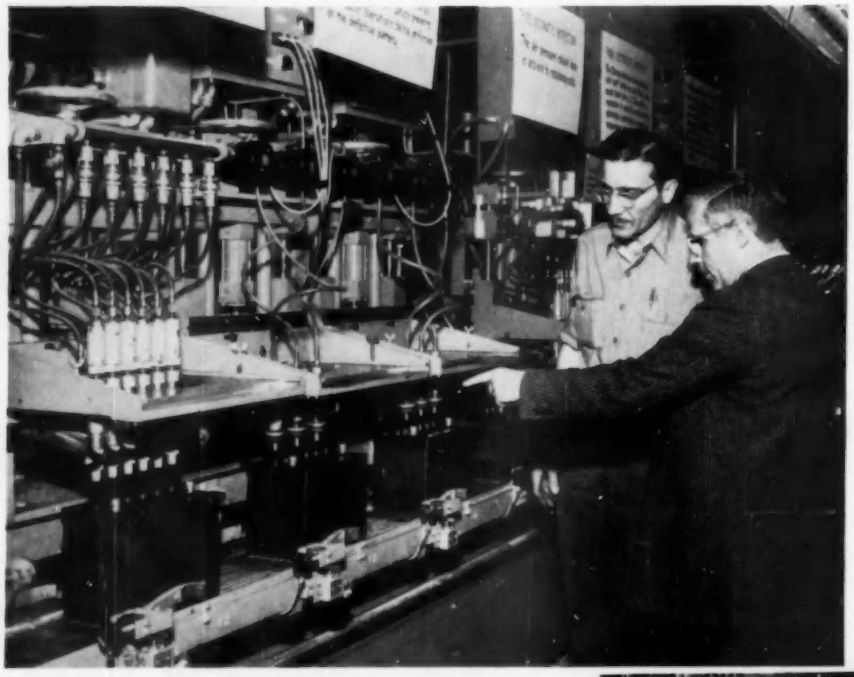
Another style note, emphasized in the 1957 models, is the increasing amount of glass area in the modern automobile. This means that there is less and less metal to support the roof and that the basic design of the car, which has been established as a cab mounted on a frame, may give way to "unitized" construction, in which the entire body and frame is a stressed unit.

Eventually, even the unitized approach will have to give way, if the trend toward more and more glass continues. Engineers foresee a "carcass" type of body-frame design in which a strong upright bulkhead will support the top and other features without use of intermediate supports. The carcass approach may already be seen on the French "Gregoire," where the frame-upright unit is a single large casting. If American cars go in this direction, a whole new field will be open for enormous aluminum castings in order to achieve strength with light weight.

(*Turn to page* 142, *please*)

# Fully Mechanized Battery Plant Has Automatic Assembly Line

By Joseph Geschelin



*Here is a portion of the continuous flow assembly line. Cases travel on the conveyor, stopping at each of the automatic stations seen at left.*

*The variety of small lead parts — cell connectors, terminal posts, etc.—are made in these die casting machines which are fitted with rotary tables.*

LATEST, and one of the most modern automobile battery plants in the USA, is the Olathe, Kansas, facility of Delco-Remy Division of General Motors Corp. The production process here is fully mechanized with an automatically operating final assembly line. It is a dry-charge type of operation, although a certain percentage of the output is shipped with electrolyte added, ready for installation in cars.

In essence its objective is to reduce, if not eliminate, the many manual tasks usually associated with battery manufacture. The final result was achieved by utilizing the experience of Delco-Remy in the development of automatic cycle process equipment and automatic cycle assembly lines which have been used in Anderson for many years. The same principles were applied to the making of batteries, resulting in methods that are apparently unique in this field.

Olathe is distinctive, too, in the fact that batteries are produced completely from the basic raw materials. They mold the cases and covers; they produce the plate grids and small lead parts; they make the paste for positive and negative plates.

Incidentally, Olathe was selected as the site best suited to a specific marketing area. For one thing, all batteries intended for the secondary or replacement

market are handled through United Motors Service Division and the plant is ideally suited to cover the market in this section of the country. In addition, the plant serves the Chevrolet assembly plant in Kansas City only 20 miles away, wet batteries supplied for this purpose being trucked to the plant. Another major customer is the B-O-P assembly plant at Arlington just outside Dallas, Texas, dry charge batteries for this plant being shipped by rail.

For a battery plant Olathe is a sizeable building with some 185,000 sq ft of productive floor space. It contains about 10,000 feet of monorail conveyors. The fully mechanized final assembly line is about 80 ft long.

The final assembly line for dry charge batteries consists of a waist-high conveyor line with a sequence of special work stations mounted over it. Battery cases complete with battery elements, prepared in another section of the plant are indexed along the line in a timed cycle, moving automatically from one station to another. All of the work stations as well as the electronic inspection stations, interspersed along the line, are electrically interlocked by means of an electronic memory circuit device which controls the entire cycle. Apart from other functions, the memory or brain circuit monitors the inspection stations and if a given battery fails to be accepted at any point it is earmarked and will not be completed at succeeding stations, although it is not physically removed from the line until the end station is reached.

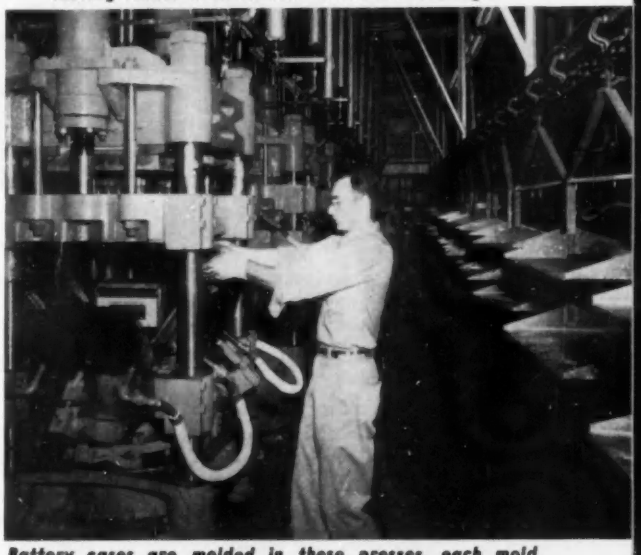
The assembly line is fed from a conveyor which is replenished from overhead storage conveyors. At the first station the cell covers are checked for proper alignment. The battery then proceeds through a series of 16 stations, including: automatic burning of cell connectors; terminal post molding with a controlled flame; terminal post topping; preheating; application of sealing compound; addition of electroylte where specified; and installation of caps on the cell covers. The latter operation is performed by means of automatic drivers, the caps being fed by magazine. The plant produces both six- and 12-volt batteries and the capping operation is so controlled that the proper type of cap is applied selectively and automatically.

As mentioned earlier, four of the stations are devoted to automatic inspection procedures, checking electrical resistance, short circuits, search for acid leaks, and a probe for proper electrolyte level. If a defect is found at any of these stations, the information is relayed to the memory circuit and the defective battery is locked out from all subsequent operations on the line.

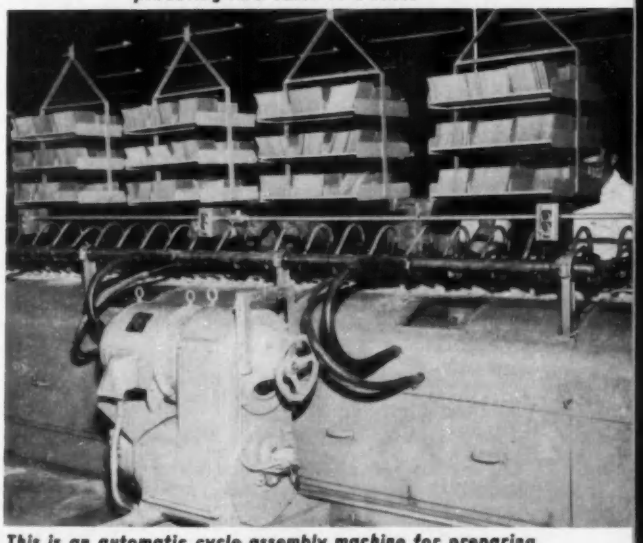
At the pre-heat station, mentioned above, the tops of battery covers are heated to proper temperature and the sealing compound flowed into place. Following this the tops are reheated once more, de-bubbling the sealing compound to assure a smooth, leak-proof seal.

Further along the line, the battery is stamped with an identifying code and both terminals coated with a corrosion preventive compound. Batteries coming off the line now are ready for painting and packaging for shipment. (*Continued on next page*)

***One of the multiple-spindle Bodine machines used for removing rubber flash on cell covers and bushings.***



***Battery cases are molded in these presses, each mold producing two cases at a time.***



***This is an automatic cycle assembly machine for preparing cell sub-assemblies which consist of positive and negative plates sandwiched with rubber separators.***

**Battery Plant (continued)**

*Grids are prepared in the rows of permanent mold casting machines seen in this view.*

Meanwhile, the various elements and components are produced by unique methods in other parts of the plant. One section, illustrated here, has a large group of permanent mold machines for producing the plate grid. Later the grids are transported to another group of automatic machines in which the faces are milled to proper thickness, then enter a section of the process equipment where the lead-oxide paste is pressed into the grid, and continue through a drying tunnel.

In addition to the battery of permanent mold machines, there are a number of rotary indexing table die-casting machines, employing open dies. These have impressions for the variety of terminal posts and cell connectors, producing the parts at an amazingly high rate.

Another department is devoted to the moldng of hard rubber cases and covers. The mix is prepared on a gallery directly overhead and fed downward to the individual molding presses.

Finally the plates are delivered to a unique automatic process assembly machine in which the positive and negative plates and rubber separators are assembled in sets to make up individual cells. As the loose assemblies leave the machine they enter an automatic burning station where plates are burned onto the terminal connection to complete the sub-assembly.

Individual cell sub-assemblies now are loaded onto a conveyorized system where they are placed in rubber cells which are then filled with electrolyte. They proceed on this line for a five-hour charging cycle. While still on the conveyor the plates are washed eight times in running water and at the end of the forming and washing cycle, they are transferred to a conveyorized drying tunnel for quick drying in an inert atmosphere. Speed is essential during this operation to prevent oxidation or reaction on the surface of the plates. Since drying is done with separators in place, the entire assembly comes from the dryer in perfect condition.

Upon emerging from the dryer the cell sub-assembly is assembled into suitable containers and cell covers put in place. At the same time the cells are electrically inspected to make sure that no moisture remains. Assembled cases then proceed to a storage conveyor ready for scheduling to the automatic assembly line.

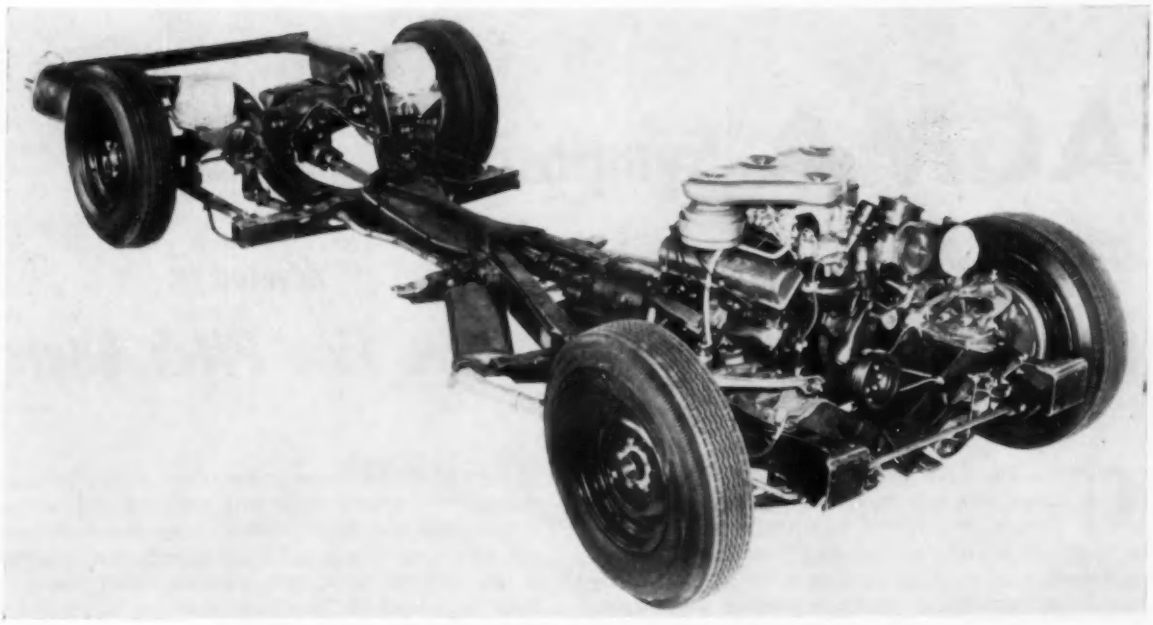
It is of interest that the plant has just one major machine shop line, consisting of the row of four Bodine multiple-spindle drilling machines, operating on an automatic cycle. They are used to remove the rubber flash from cell covers and bushings.

• • •

### *Ford Studying Ways To "Insulate" Car Glass*

At least a partial answer to the problem of preventing summer heat rays from filtering through automobile windshields and window glass may come from experiments being conducted at Ford's Scientific Laboratory. The work involves the use of a number of metal foils such as silver, aluminum, zinc, titanium, uranium and even gold, whose atoms are bombarded onto the glass.

In the experiment, the foil is placed in a vacuum with the glass to be coated, or "insulated." The foil is then melted electrically and its atoms sprayed on the glass at speeds above 5000 miles an hour. A light meter is used to stop the "bombardment" process before the coating on the glass becomes too heavy. The gold coating used on the glass is about 30,000 times thinner than a human hair.



*1957 Eldorado Brougham chassis equipped with the new air suspension system.*

# New Air Suspension for Eldorado Brougham

A SUSPENSION system in which air springs replace steel springs has been introduced in the Cadillac Eldorado Brougham. (See illustration of car on page 36, Dec. 1 AI.)

In this system the car rides on four air springs (one at each wheel), which maintain the car at a constant level as well as smooth out rough roads. It does these things regardless of the car loading and road conditions.

These air springs replace the conventional steel coil springs in the front and the semi-elliptical leaf springs in the rear.

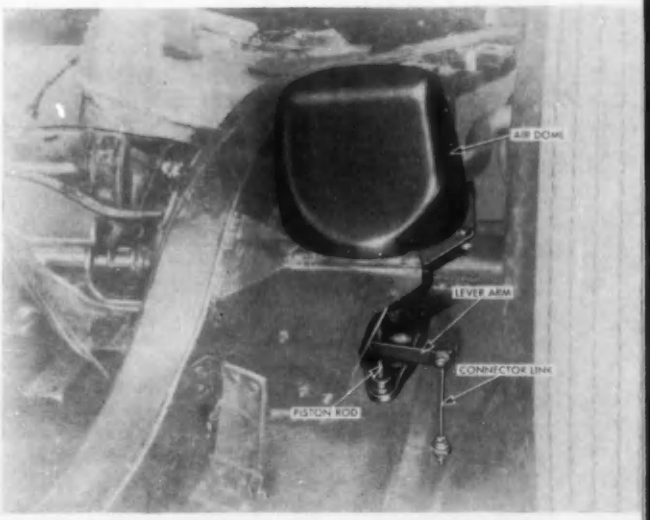
A description of the basic components of the system and their functions follow:

● FOUR AIR SPRING ASSEMBLIES, one at each wheel, replace the conventional steel springs. They support

(*Turn to page* 156, *please*)

**CONDENSED SPECIFICATIONS**
**1957 CADILLAC ELDORADO BROUGHAM**

| | (in.) |
|---|---|
| WHEELBASE | 126.0 |
| HEIGHT | 55.5 |
| LENGTH | 216.3 |
| WIDTH | 78.5 |
| MINIMUM ROAD CLEARANCE | 5.3 |
| ENGINE | |
| Type | OHV V-8 |
| Horsepower | 325 |
| Speed | 4800 rpm |
| Engine Fuel Feed | Dual 4-Barrel Carburetor |
| Compression Ratio | 10:1 |
| Torque | 400 ft lb |
| Speed | 3200 rpm |
| Bore and Stroke | 4 in. x 3.625 in. |
| Displacement | 365 cu in. |
| TRANSMISSION (Standard) | Hydra-Matic |




*Here is the air spring assembly which is a part of the air suspension system. The function of this assembly—there is one at each wheel—is to support the weight of the car, compensate for uneven road surfaces without noticeably affecting the normal position of the body, and maintain the standing height of the vehicle regardless of car loading.*

# AGMA Symposium . . .

## *devoted to*

## *Ultra Fine Pitch Gears*

**By**
**Thomas Mac New**

ULTRA fine pitch gearing, a topic of growing interest and concern in our industries, was the subject of a recent AGMA symposium. Held in conjunction with the American Gear Manufacturers Association semi-annual meeting in Chicago, the symposium covered design, hobbing, shaving, and inspection.

Paul M. Dean, Jr., gear specialist, Aeronautics & Ordnance, General Electric Co., and Chairman of AGMA's fine-pitch gearing committee, was moderator of the session. In his opening remarks, he stated that today, more than ever before, there is a strong trend to reduce the size, weight, and when possible, the cost of most of our consumer and military goods. In many cases where these factors have not been reduced, as in passenger cars, the individual components have been given more work to do and many more have been added in the same space, Mr. Dean went on to say. The military has placed the most emphasis on the need for miniaturization.

Papers were presented by T. W. Khiralla, vice president, engineering and research, Unitron Inc., on design; M. Samuelson, Barber-Colman, on hobbing; G. Sanborn, general sales manager, Fellows Gear Shaper Co., on shaping and shaving; and Louis Martin, gear consultant, on inspection. Extracts follow:

### The Design of Ultra Fine Pitch Gearing

By T. W. Khiralla

GEARS made to specifications finer than 100 D. P. are now being used for rockets, missiles, and all types of mechanisms and instruments where space requirements are limited. They may be used for slow speed gearing or in applications where the speeds are extremely high. Many operating conditions are indicated and it will be up to the designer to provide a gear drive that will meet all of the requirements for a particular application.

In order to produce the gears to the design specifications established we must have the equipment and the personnel conditioned to do this work. The time is fast approaching when new types of machine tools must be designed and built. Much of the existing equipment is not adequate for the production of the present three classes of precision gears.

In the present discussions we are only concerned with spur gears of involute tooth form — the geometric curve used in most gear applications. As of the moment it seems that the tooth proportions of the 14½ deg and 20 deg pressure angle basic racks as defined in the present AGMA standards are adequate for most applications.

In designing gears of this type, care should be taken to properly check for tip, involute and trochoidal (or fillet) interferences. In most instances the only tooth modifications, or profile adjustments, we have found necessary are those requiring gears made larger or smaller than the so-called standard or nominal proportioned gears. The development and use of gears made to some standard are valuable and useful for many applications but in our own work we encourage the engineer to make full use of the involute and its many desirable properties.

The amount that pinions, having low numbers of teeth, should be enlarged is not dictated by any established values contained in a handbook or published table. The design of gears is dictated by the conditions of the problem before us. The angle of approach and the angle of recess receive a great deal of attention in our work and in many cases where conditions permit, we have used all recess action gear drives with considerable success. We feel that the proper application of this principle will lead to smoother gear drives and extend their useful life well beyond those of conventional design.

There are other factors that must be thoroughly investigated; such as contact ratio, clearance, backlash, smoothness of tooth profile, total tooth depth and pressure angle. All of these features must be properly selected in order to produce gears that will perform the duty required of them. Proper location of the pitch surfaces must not be overlooked.

In the ultra-fine pitch area where gears must be made as small as possible because of the limited space in which they operate, it is of paramount importance that the tooth design be so developed that the maximum life will be obtained. In many cases we have achieved this by tooth

profile adjustments without resorting to hardened or heat-treated gears or by the use of high strength alloys.

When we design gear trains in the ultra-fine pitch range we become more concerned with the power losses due to the sliding between the mating profiles. In general, the power flowing through the train is relatively small, and probably in most instances, the train is designed for the transmission of motion only. In such instances we may find it necessary to improve the action between the mating profiles.

It has been found that the co-efficient of friction during the approach action, with the pinion as the driver, is about double that of the recess action. This detail is one that should be considered in the design of positional gear trains where the loads may be so small that the friction may affect the end result. In such instances it may be well to investigate the use of all recess action drives.

The surface finish of such gearing should also be closely controlled, but unfortunately, no reliable methods have been found to measure the microfinish obtained. The best we can do at the moment is to examine the tooth surfaces with a magnifying glass of sufficient power and compare the finish against surface finish gages by visual means.

## Hobbing Ultra Fine Pitch Gears

### By M. Samuelson

HOBBING machines, hobs and tooling have been developed that make the hobbing process adaptable to manufacturing fine pitch gears, many of which fall into AGMA precision class II. This class calls for 0.0003 in. adjustment and 0.0005 in. non-adjacent composite tolerance. Precision hobbing machines with a single thread indexing worm and Class "AA" hobs provide a desirable combination to produce such gears. These hobbing machines use parts that are hand fitted to very close tolerances.

Proper tooling is another important factor in producing accurate fine pitch gears. It should be rigid and made to close tolerances.

Ultra fine pitch gears usually have width of 1/16 in. or less. The diameters vary according to the number of teeth. Pinions are, as a rule, of the stem type. It is not uncommon to have a pinion with an outside diameter of 0.080 in.

Gears are no better than the accuracy built into the gear blank. Often, in a gear design calling for a 0.0005 in. composite accuracy, the blank will have a tolerance of 0.0005 in. on the bore and a 0.0005 in. limit on parallelism of the gear faces. To make a gear to 0.0005 in. accuracy, the gear blank accuracy should be 0.0001 in.

Since one face on the gear develops a burr where the hob breaks through, a revolving circular form tool should be used to remove all burrs. As the hob cuts through, the spring loaded form tool with its concave surface will shear the burr from the face of the gear.

Hobs that are used for manufacturing ultra fine pitch gears are usually manufactured to Class "A" or "AA" tolerances. The outside diameters of these hobs will generally run from ¾ in. to 1⅜ in diam. Bores sizes are 0.315, 0.500, 0.750 in. and tapered. There are times when we have to deviate from standard dimensions. Stem pinions are a case where hob diameter has to be special. Frequently there is a shoulder or a bearing that the hob is not allowed to cut into. It may even necessitate making a shank type hob. The gear designer should bear in mind when designing a stem pinion that if at all possible, allow for a standard diameter hob. It makes it easier and cheaper to make both the gear and the hob.

Fine pitch hobs are normally made from 18-4-1 high speed steel, also known as T1. This steel gives good tool life and is ideal for grinding.

What the future holds for the ultra fine pitch field we don't know. Twenty years ago a 64 D. P. hob was considered a very fine pitch. Today, a 120 D. P. hob is a stock item. It's conceivable that 20 years from now a 220 D. P. hob will be standard.

We have at this time made a 64 D. P. hob, four inches in diameter with 30 flutes. It was ground to one-half Class "AA" limits. Tolerances were 0.0002 in. adjacent and 0.0005 in. non-adjacent sharp tolerances. Lead limits were 0.00003 in. tooth to tooth, 0.00007 in. one turn and 0.00015 in. in three turns. These tolerances on a four-inch diameter hob would probably make the hob four or five times more accurate than standard requirements call for.

Carbide hobs have been successful in the 150 D. P. range. They perform well on certain materials such as fiber, phenolic, and bronze. In some cases tool life has been increased from four to 40 times.

## Shaping and Shaving of Fine Pitch Gears

### By G. Sanborn

A MACHINE commonly used for shaping fine pitch gears is the Fellows 3 in. fine pitch gear shaper. Coarsest pitches recommended to be cut on this machine are 32 D. P. in brass and 40 D. P. in steel.

This machine is being called upon continuously to cut to closer and closer tolerances. Here, like in other operations, close tolerances cost money. They necessitate special machines and precision cutters.

Where standard gear shapers have cut accurately enough in the past, today we strive to get these better results by modifying the standard gear shapers, using special spindle bearings, super accurate worms and worm wheels, more accurately finished change gears, etc. This is a stop-gap but not the answer. Better gear shapers will be built and the cost will be high. The degree of accuracy that will be obtained cannot be closely estimated at this time. Undoubtedly,

(*Turn to page* 138, *please*)

*View of new furnaces, showing five of a bank of eight*

# Modernized Foundry Can Turn Out 75,000 Aluminum Pistons Per Day

## By George E. Toles

An extensive modernization and expansion program at the aluminum piston foundry of Chrysler Corp. in Highland Park, Mich., has resulted in an increase in output capacity of about 50 per cent, together with still further improvement in quality. Up to 75,000 aluminum pistons of a single type can now be produced at the foundry in a 24-hour work day, compared with 52,000 previously.

### EXPANDED FACILITIES

The new expanded facilities will enable the foundry to supply 75 per cent of expected piston requirements for Plymouth and Dodge V-8 engines, 100 per cent of the pistons for Plymouth six-cylinder engines, and 100 per cent of the pistons for the De Soto and Chrysler V-8 engines. The Highland Park foundry will also be able to supply all Dodge truck piston requirements.

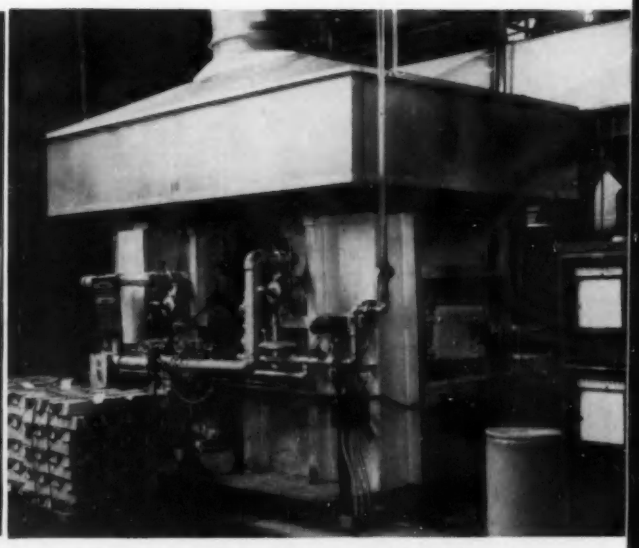
In the modernization program, 16 automatic casting machines and eight new dry-hearth combination melting and holding furnaces were installed, making the plant one of the largest in the country of its type.

### IMPROVED QUALITY

Improved piston quality is expected to result from the use of more efficient aluminum-melting equipment, and closer control of casting processes made possible by the new equipment.

Dimensional-tolerances also will be easier to main-

*Pouring of aluminum alloy into molds*



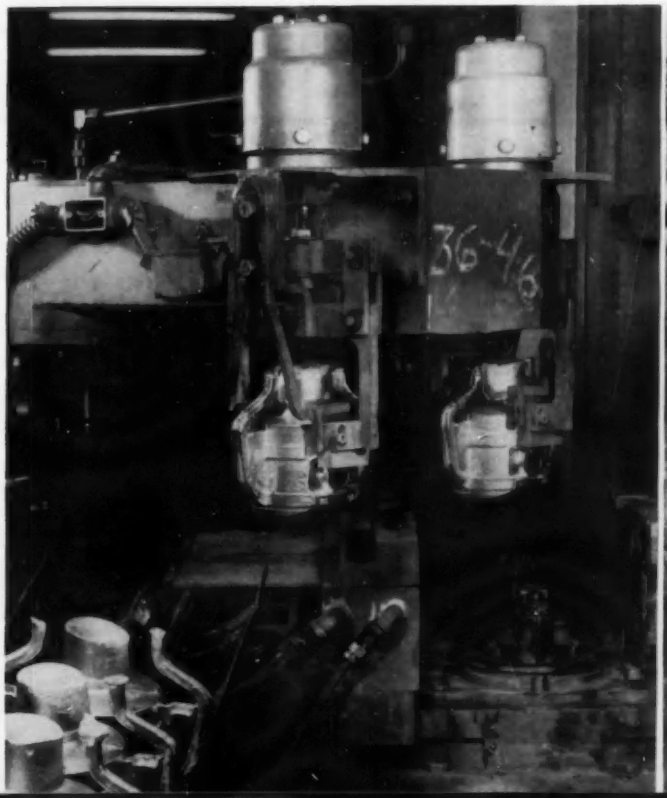
*Dry-hearth combination melting and molding furnace*

tain since key operations are automatically cycled. Precise control of cooling further assures consistent quality of the pistons, as noted in illustration, page 58.

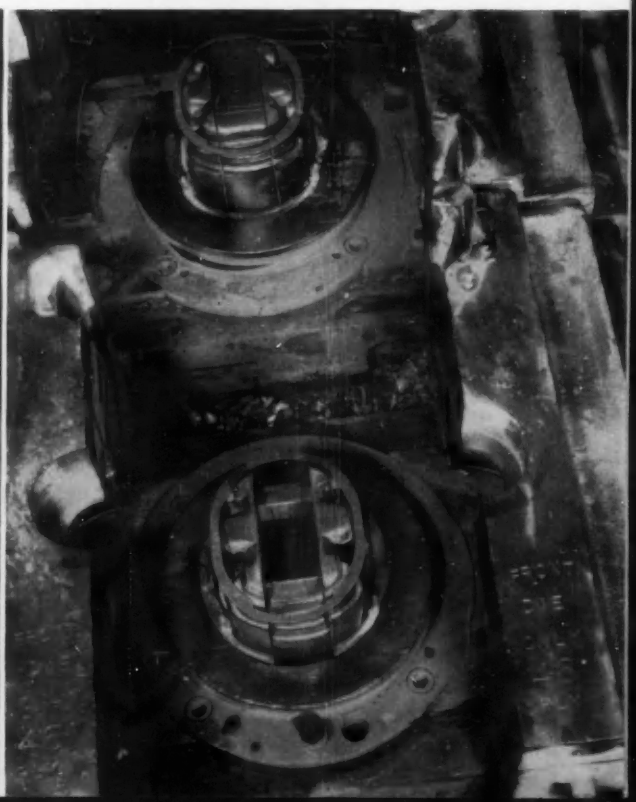
**AUTOMATIC CASTING MACHINES**

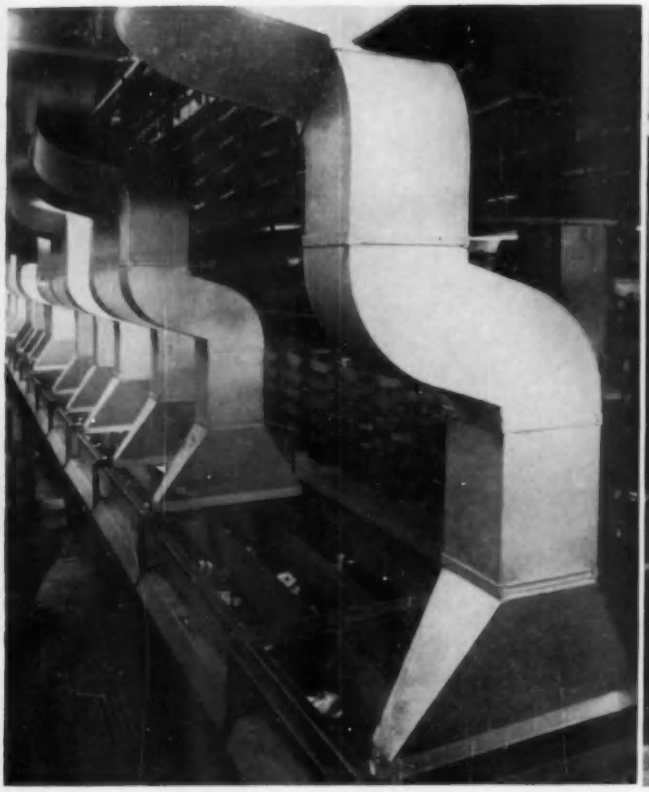
The new casting machines open and close automatically on a predetermined timing cycle, with molds and cores held at controlled temperatures by means of a water cooling system. Steel inserts, which control piston expansion and contraction when in the engine, are placed on the cores automatically. The cast piston is ejected from the machine onto a conveyor. (*Cont'd*)

*Mechanical arms lifting newly poured pistons from molds*




*Close-up showing cores with steel inserts*





*Ducts forcing cool air onto main conveyor carrying hot pistons to trimming station*

*Main conveyor with pistons nearing hopper where they are taken for trimming*

#### EIGHT NEW FURNACES

Each of the eight new furnaces has 14 sq ft of melting area, and is capable of melting 900 lb per hour. The molten metal is then collected in a holding chamber, which holds approximately 3000 lb of molten metal at pouring temperature.

Pistons produced by the new automatic permanent

## Designing Leaf Springs for Improved Riding Qualities

THE full potential of leaf spring design has yet to be realized, according to Detroit Spring Products Division, Fenestra, Inc. The fact is that after 50 years of service flat leaf springs continue to play an important role from the standpoint of engineering economics both in passenger cars and commercial vehicles.

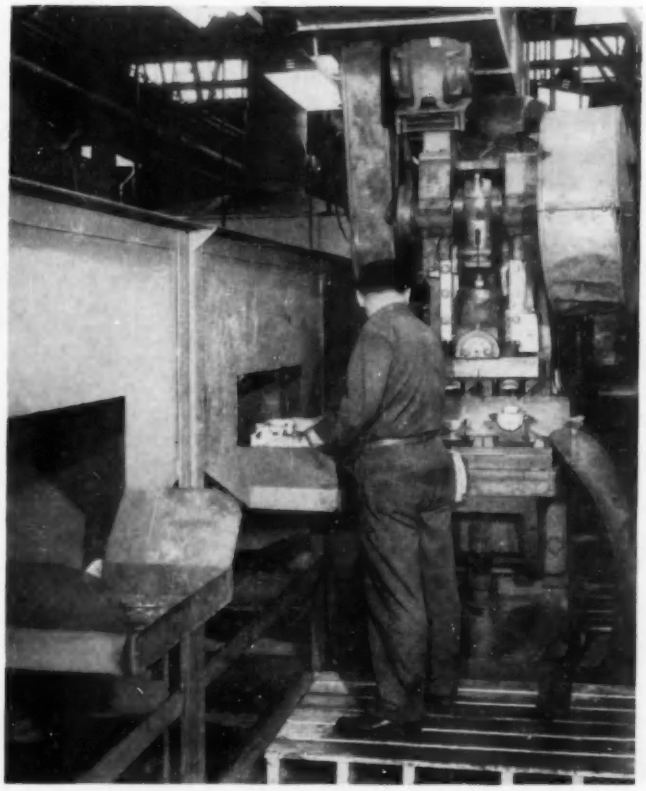
According to DSP, a flat leaf spring can be designed to fit any desired ride conditions in commercial vehicles, in any range, so long as the vehicle designer will accommodate the necessary variations in length, width, camber, etc.

Over the past 15 years gross vehicle weights have categorized flat leaf spring designs and the rate of deflection of the spring has been subordinated to its load-carrying qualities, often to the point that springs perform their function in a manner which does not provide a good ride.

Current research and development programs embracing the use of longer springs, variations in width and thickness of material, fewer leaves, less camber or any one of many combinations of the foregoing, are probing the true potential of the flat leaf spring. Since this approach to the elimination of "hard ride" in trucks (through the medium of redesign in flat leaf suspension springs alone), does not necessitate increased frame weight, strengthened cross members, the addition of shock absorbers, air compressor capacity and storage, radius rods and similar addenda, the subsequent saving in suspension system costs is apparent.

Recently, completely satisfactory riding comfort has been accomplished by the design and adoption of two-stage springs, both front and rear, in school buses and light model trucks. A floating ride has been achieved experimentally, on trucks in the two to two-and-one-half-ton range, through the use of radically changed design characteristics of the springs used in the suspension unit.

Rebound has been definitely controlled through the adoption of more closely computed leaf curvature, thus



*Trimming station where gates and risers are removed from the castings*

casting machines are carried through succeeding production stations automatically by a series of conveyors —from each casting machine through the trimming station, into the heat-treating oven, and to the final shipping racks, where they await delivery as ordered.

### NO HANDLING HOT PISTONS

The conveyors make it unnecessary for personnel to handle hot pistons as they come out of the molds. A new blower system forces a steady stream of cool air over the main conveyor line which carries the hot pistons.

### CASTINGS KEPT SEGREGATED

Plate steel guides mounted above the belt form three longitudinal channels, permitting three types of pistons to be segregated and transported simultaneously. The conveyor runs behind the line of machines and feeds a cross belt which discharges onto an inclined belt. Castings are kept separated on all changes and are switched off the elevated belt to chutes leading to three bins.

### GATES AND RISERS REMOVED AT SHEARS

Operators at power shears beside each bin remove gates and risers while apron conveyors under each shear carry gating metal to a fourth apron conveyor which discharges into a tote box. Box-loads are trucked to the furnace area where gates and risers are charged directly into the furnaces.

Shear operators place pistons on shelves of an overhead monorail conveyor, which carries them through a heat-treating furnace for precipitation hardening. The treating cycle is four hours at 425 degrees F.

### PRECISION CONTROL THROUGHOUT

Chrysler's quality control program includes weight and dimensional checks performed twice a shift on three pistons from each casting machine. Metal analyses and piston X-ray examinations are performed at least once a day. Piston weights are very important and must fall within a narrow range.

eliminating the necessity for shock absorber equipment. Or, if the unit is so equipped, greatly increasing the life of the shock absorbers by the spring sharing a substantial portion of their function.

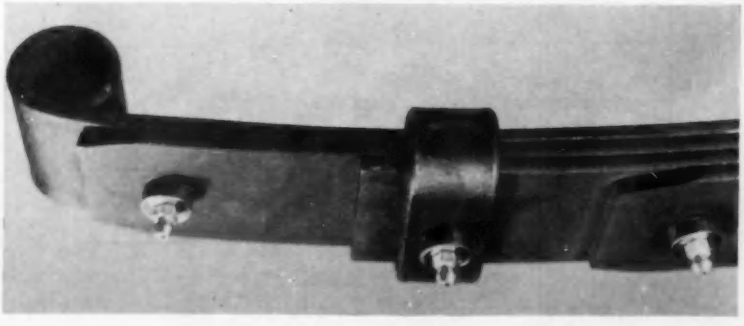
Fittings for lubrication (see illustration) between spring leaves have added a friction-reducing component to flat leaf springs; and with a year's history of satisfactory usage behind it, greatly expanded adoption of this component is anticipated.

Side-sway has been controlled to a point of complete safety for loads of maximum height permitted on the highway, through the adoption of strengthened eyes, redesigned bushings and increased leaf width — all integral parts of the spring itself.

Last, but extremely important, is the fact that trucks are driven and stopped through the eyes or end modifications of flat leaf suspension springs, and the flexibility of the alloy steel in the springs becomes a characteristic of the suspension as a unit — thus absorbing the thrust of sudden stops and starts of the car.

In suspension systems not employing flat leaf springs, this reaction is transmitted directly to rigid radius rods or other supporting frame members.

*Fittings for lubrication between leaves of spring*



# What Price Executives?

## A Survey of Current Salary Trends

TOP management in industry received larger salaries and bonuses in 1955 than it did the previous year, according to a survey just completed by the staff of McKinsey & Co., management consultants. The results of this survey, which are based on data filed with the Securities and Exchange Commission by 606 companies in 18 major industries, are published in the November issue of the *Harvard Business Review*.

How did executives in the automotive industries fare by comparison with leaders in other fields?

AUTOMOTIVE INDUSTRIES asked Harvey L. Thomas of McKinsey & Co. to make a special report on automotive salary trends and to analyze some of the factors that influenced current patterns. His findings are based upon reports submitted to the SEC by 12 automotive manufacturers, 30 automotive accessory manufacturers, 25 aircraft manufacturers, and 10 airlines.

CHART 1

TOTAL COMPENSATION OF CHIEF EXECUTIVE OFFICER RELATED TO 1955 NET PROFITS IN THE AUTOMOTIVE AND AIRCRAFT-AIRLINE INDUSTRIES

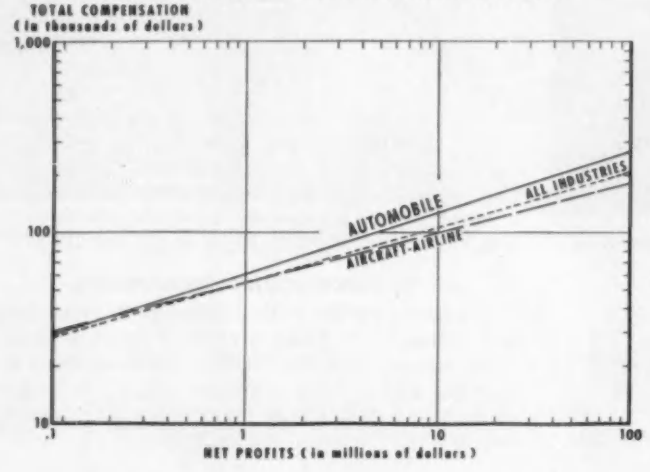
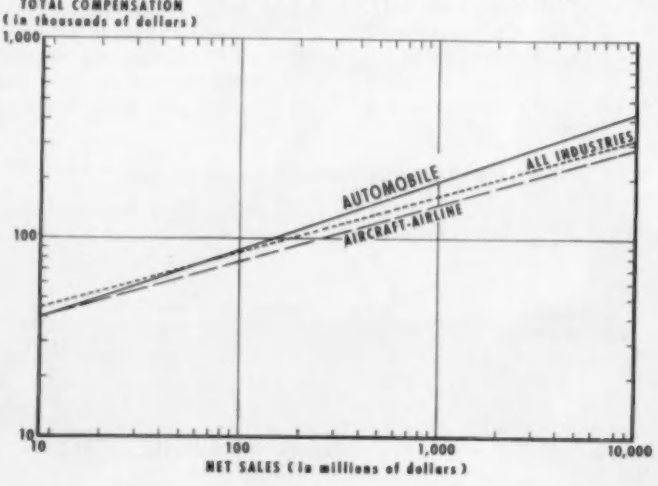



CHART 2

TOTAL COMPENSATION OF CHIEF EXECUTIVE OFFICER RELATED TO 1955 NET SALES IN THE AUTOMOTIVE AND AIRCRAFT-AIRLINE INDUSTRIES




### COMPARISON WITH OTHER INDUSTRIES

Table I compares the automobile and aircraft industries with other major industries. This comparison reveals that boosts for executives as a whole in both of these industries were well above average, and were matched only by the rubber and steel industries.

TABLE I

Average Percent Increase or (Decrease) 1955 vs 1954

| Industry | Chief Executive's Compensation | Industry Sales | Industry Profits |
|---|---|---|---|
| Steel and Iron | 17.4 | 40 | 136 |
| Rubber | 15.9 | 25 | 91 |
| Airlines and Aircraft | 15.0 | 5 | 14 |
| Automobiles | 10.0 | 27 | 74 |
| Retail Trade | 9.9 | 8 | 18 |
| Textiles | 8.2 | 20 | 72 |
| Paper and Paperboard | 7.7 | 13 | 24 |
| Chemicals | 6.8 | 18 | 43 |
| Building Materials | 5.9 | 21 | 47 |
| Metal Mining | 5.9 | 40 | 67 |
| Petroleum | 4.9 | 11 | 13 |
| Drugs and Cosmetics | 4.4 | 21 | 35 |
| Light Machinery | 4.0 | 15 | 31 |
| Utilities | 3.3 | 12 | 15 |
| Heavy Machinery | 2.5 | 5 | 36 |
| Railroads | 1.8 | 8 | 27 |
| Food | 1.0 | 5 | 15 |
| Electrical Equipment | (2.2) | 5 | 13 |

Sales of the 606 companies studied were up an average of 15 per cent and profits jumped 34 per cent. Over-all, 80 per cent of the companies showed sales gains; 70 per cent indicated profit increases.

The automobile industry was well

(*Turn to page* 132, *please*)

## *New Developments Studied at*

# Fourth Annual Meeting of ICI

ALTHOUGH the Investment Casting Institute was formed only four years ago, it has grown rapidly in stature. Over 100 specialists attended each of its two technical meetings held in Detroit November 15 and 16. Two significant advances were studied in the technique of investment casting—the Glascast shell process and the Investment "X" process.

It may be well to say at once that the useful and most economic applications of investment castings still are confined to complex facts not readily made by more conventional means; to intricate parts having extremely fine tolerances; and to castings that must be made of hard-to-machine metals. The process is so costly at present as to make it non-competitive except where special conditions obtain. On the other hand, investment casting can be adapted in some instances to replace complex fabricated parts which normally are made up of a number of separate pieces which must be joined by soldering or welding.

Glascast shell molds—which have a similarity to the shell molding foundry technique—were discussed at length by Dr. N. J. Grant of MIT and Karl D. Scheffer, Corning Glass Co. This new technique employing a special glass slurry, produces a ceramic shell of one piece instead of the bulky investment mold now being used. It results in strong, light-weight shells or molds which resist thermal shock effectively and thus reduce rejects and cracked molds. This technique, after it has been reduced to practice, will increase production rates and from that standpoint may eventually promise lower cost. Among its other advantages is that it aids in decreasing decarburization in ferrous castings.

The Glascast process employs lost wax cores common to investment casting procedures. However, instead of bedding the core or cluster in a large mold, the wax patterns are dipped repeatedly in a suitable slurry to build up the desired thickness of the shell. What takes time is the drying of each coat before the next is applied.

Each of the coats is called a "slip" and the process of building up the shell termed "stuccoing." Scheffer, who is a ceramic specialist, described experimental work conducted by Corning in this connection. According to Scheffer, the first coat—the one in intimate contact with the molten metal—is the most critical. He recommends use of a special clay for this coat to produce high yield (or thickness) as well as strength. This takes a longer drying than do the subsequent vitreous silica coatings.

Scheffer also recommends the use of low expansion waxes to reduce the hazard of damaging the shell because of wax expansion upon melting. He believes that with low expansion wax the caster can employ the same gating systems as for conventional investment procedures.

Whereas the Glascast shell method is intended exclusively for small castings, the Investment "X" process, developed by Metro Vick of England, is a shell technique for making very large castings by the lost-wax process. Some recent castings for aircraft components range in weight from 56 to 110 lb.

In this process the wax patterns are dipped progressively in a slurry (composition not disclosed) with the first coat of a special high strength material. The entire system of coatings has extremely high permeability. Advantage is taken of this property to remove wax by solution, the wax leaving the mold through the pores of the shell. This disposes of the problem of wax expansion.

According to Noel Shaw, Shaw Process, Ltd., who presented the paper, the process lends itself to automatic methods in the building up of the shell, removal of the wax, and subsequent pouring. Wax is removed by conveying baskets containing the green shells through a trichlorethylene degreaser. The vapor surrounding the shells dissolves the wax and both products pass through the pores of the shell. In this manner the wax may be recovered.

One full day was devoted to a symposium on vacuum melting and casting. Vacuum melting is of vital importance to the automotive industries in many respects. Admittedly it is an extremely high cost technique at present. Consequently, it is not competitive with conventional methods of metal refining. However, it is the only available means for producing high purity, high strength metals and alloys so urgently needed for jet engine components.

Dr. N. J. Grant of MIT listed the principal advantages of the process for high purity metals and alloys as follows:

1. Degassing of the molten mixture to remove oxygen, nitrogen, and hydrogen.
2. Clean structure without inclusions
3. Close control of oxidizing elements such as titanium and aluminum
4. Elimination of tramp elements

The high cost of metals produced by vacuum melting makes it imperative to study the economics of any given material. The situation was well expressed by Dr. Jack Keverian of General Electric when he said that "vacuum melting may well provide the answer to the question of how design engineers can obtain

(*Turn to page* 161, *please*)

# Quality Control Vital in TorqueFlite Production

CHRYSLER TorqueFlite transmissions built in the Kokomo, Ind., plant are being subjected to an amazing variety of inspections and quality control steps. Besides the detail inspection of each individual part during the manufacturing process, as described here and there in previous articles, the final assembly operations include some noteworthy controls. For one thing, the valve body assemblies are subjected to a complete schedule of operational checks in Merz inspection machines before they leave the sub-assembly area.

After the transmissions have been completely assembled, they are routed to the final inspection test stands where they are put through a complete operating cycle. As will be mentioned later, in the event that defects or malfunctioning are discovered, the assembly is returned to repair stations. In addition to such dynamometer testing of each assembly, a number of transmissions are removed at random each day from the banks of accepted units and shunted to the road test department. Here they have a group of current model cars representative of each of the customer divisions—Imperial, Chrysler, Dodge, DeSoto, Plymouth—and the sampled transmissions are road tested in these cars.

Superimposed on this quality control setup is still another routine. This is the formal dynamometer testing of Chrysler's TorqueFlite transmissions hooked up with a suitable V-8 engine, testing being done under the supervision of resident engineering. This may be considered as a long-term continuing research project, subjecting the drive not only to operational procedures but endurance and other features of interest from an engineering standpoint.

Final assembly is recognized as being one of the most important steps in the manufacture of an automatic transmission once the components have been accepted and made ready for installation. At Kokomo the extensive assembly department is completely enclosed, isolated from the machining bays, and provided with fresh, filtered air which is held at a constant temperature. Good housekeeping and cleanliness are the predominant characteristics of the operation. In fact, the management has gone all the way, providing

# PART III

## By Joseph Geschelin

towel racks with endless rolls of cloth toweling throughout the entire assembly area within easy reach of all operators. These people have been trained to use the towels constantly to remove dirt and oil from their hands so as to keep the work clean.

A noteworthy feature of the assembly operation is the provision of a large parts storage area, immediately outside of the enclosure, arranged to accommodate 10,000 pieces of each component part. This area is covered by 80 sections of skate wheel conveyors. Each of these sections is pitched downward from the loading end to the discharge end. As the parts are required for assembly they are loaded in baskets and transported by conveyor into the assembly area. This system facilitates stock rotation since the oldest stock rolls down to the discharge end and is consumed first. Inventory and counting are simplified since parts of the same part number are always kept in a designated section of the storage conveyor.

In aiming for cleanliness, the procedure is so arranged that nothing is permitted to enter the assembly enclosure without undergoing a fresh wash. Thus all of the component parts in the storage area, including cases which travel on their own conveyor, are run through a large washing machine, installed just outside the assembly department, before entering assembly. This is done despite the fact that every part is washed a number of times during the course of fabrication.

The arrangement within the assembly department features a series of sub-assembly conveyor lines which feed at right angles to the final assembly line. Among these are valve body assembly, power train assembly, case sub-assembly, etc. Facilities for valve body assembly are quite extensive, including an over-and-under conveyor system; and a group of five Merz test stands for operational inspection. As illustrated, the valve assembly is integrated on individual stands mounted on the conveyor.

The power train attachment is built up on another of the conveyor lines which boasts an eight-spindle nut runner for making up the fastenings.

As transmission cases enter the department on a monorail conveyor they initiate an automatically controlled chain of events. The conveyor enters adjacent to the case sub-assembly line. At this point cases are automatically unloaded one by one from the conveyor hooks by a trigger mechanism which operates only when there is room for one or more additional cases on the chute that feeds to the start of the line. If the chute is fully loaded, the cases remain on the conveyor and run idle until they are removed.

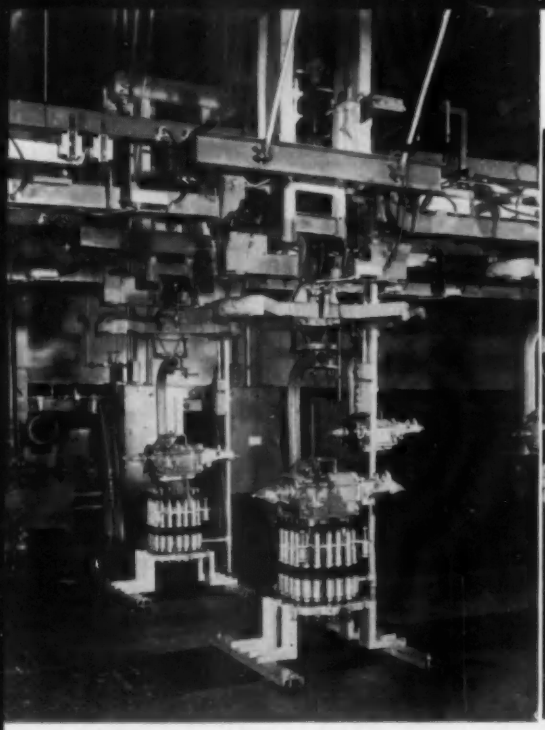
We have now reached an area of operation that is exclusively the province of one of the latest installations of a Jervis B. Webb, four-inch, power-and-free

**VIEWS ON VALVE BODY ASSEMBLY LINE**

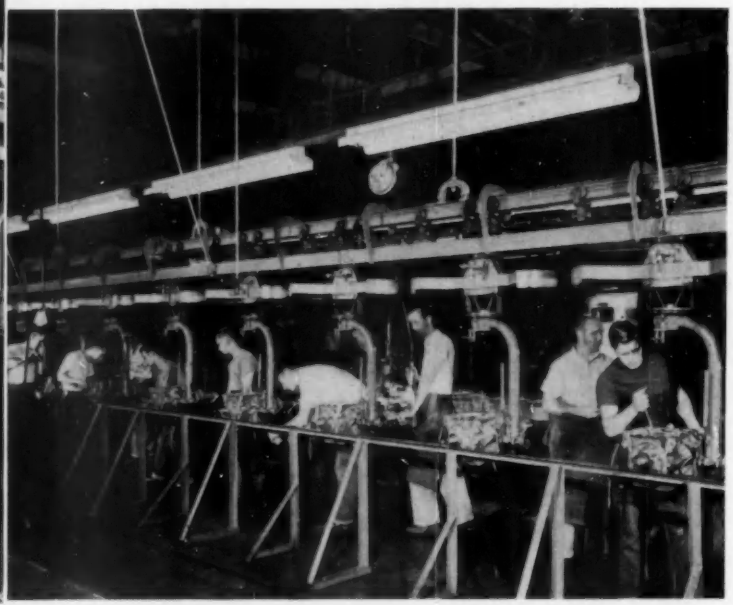
**FAR LEFT—**
***Valve body assembly line. Note the towel racks in background.***

**MIDDLE LEFT—**
***Example of a vertical Kingsbury machine for handling a variety of operations on all valve bodies.***

**IMMEDIATE LEFT—**
***This is one of the special Heald machines, with central trunnion fixture, for fly-cutting the sides of valve bodies.***



*Eighteen fastenings are made up automatically on each of the stations seen here. During the cycle the transmissions remain on the Webb power-and-free conveyor.*



*Automatic nut runner stations on the transmission assembly line. Note that the power-and-free conveyor serves as the final assembly line.*

## VIEWS ON TRANSMISSION LINE

material handling system. Completely automatic movement of work starts at the end of the transverse case preparation conveyor. At this point the case is attached to the power-and-free conveyor carrier and this section then becomes the final assembly line. The assembly is built up completely while moving on its carrier. As the line transverses the various sub-assembly lines, the finished sub-assemblies are transferred one by one and integrated by the operator at that station.

This section of the power-and-free system then loops around, moves upward out of the way, and transports the assembled units to the final test area. At the present writing there is an installation of 16 Merz transmission dynamometers for putting the Chrysler TorqueFlite units through their paces. As the conveyor, loaded with transmissions enters this department it automatically seeks an open test stand along the line. As an open stand is signalled, the first case near that point enters a switch track leading to the test stand. The carrier now is "free" and under control of the operator. Each test stand is served by an air hoist by means of which the carrier may be lowered into position for testing the transmission. After the test schedule has been completed, the operator presses a button to elevate the carrier to the level of the overhead conveyor.

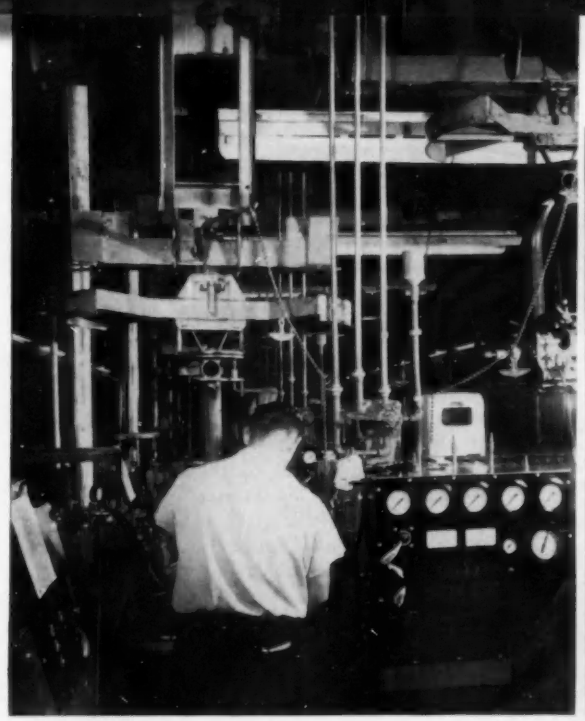
Following the test stand procedure, the carriers take one of two courses. If the unit is acceptable, the operator sets the selector switch on the carrier accordingly; if the unit fails to pass the test, the operator sets the switch for "repair." If acceptable, the carrier returns the unit to the assembly area for installation of the oil pan. If the unit is consigned to "repair" the conveyor transports it into the assembly area, then switches it to the repair area where the carrier rests on a "free" section.

After suitable repairs have been effected, the carrier once again is set for "test" and joins the procession of transmissions on their way to the test stands.

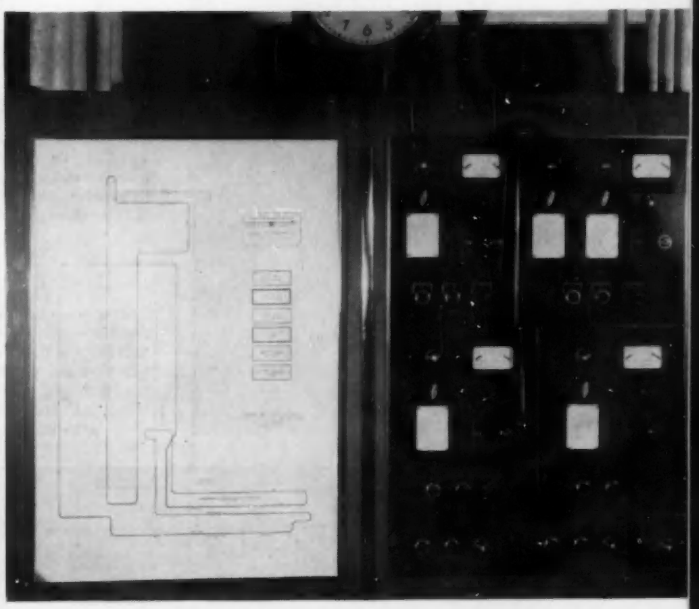
Accepted units, however, switch automatically to the last section of the power-and-free system for installation of the oil pan and gasket. Operators along this line also insert the fastenings and start them in place. The assemblies then proceed to the end of the department where once again they reach a major switch point. Here there are two impressive multiple nut runner machines, each one making up 18 fastenings at a time. At the switch junction, the main conveyor line receives a signal indicating which of the two nut runners is open. It then automatically switches the first transmission in line to the open station. If both stations are busy the line will bypass and continue to move until a station is open.

As an assembly is switched to the nut runner, it approaches automatically and lowers automatically to engage the station. When the operation is completed, the carrier is elevated automatically and shunted to a free section of track immediately following.

Let us now cover a few machine shop operations to



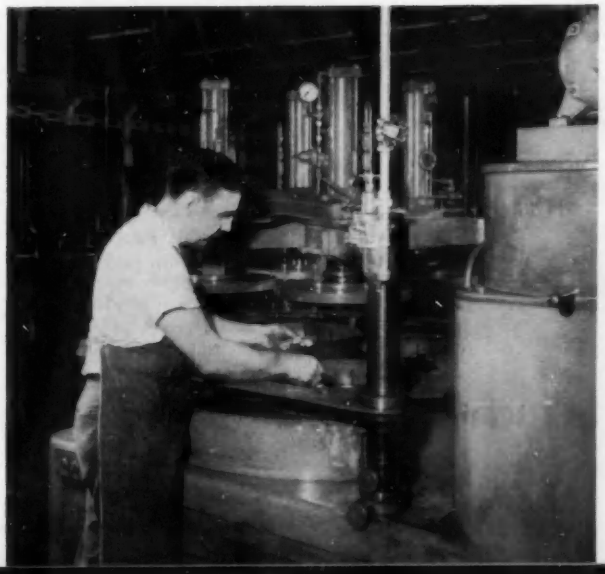
*Final test area served by Merz dynamometers. Assemblies come in on power-and-free conveyor at right, are lowered into the test machine cradle by the air lift in foreground.*



*A view of the J. B. Webb power-and-free conveyor system control board at Kokomo plant. Operation of the entire power-and-free system is controlled from this board.*

round out the sampling made in previous studies. One of the most interesting places in the plant is the aluminum machining area. We mentioned in an earlier article (see AI, November 1, 1956) that the management had conducted considerable experimental work with industrial diamond tooling. Its major objective was to develop fly-cutting techniques that might be effective in eliminating the lapping of mating faces. However, it was decided later that the functioning of the valve assembly was so critical and so dependent upon fine flat surfaces that lapping is a must as a protective measure. Consequently, the diamond tool program is being held in abeyance until further experience has been gained.

*One of the many Crane Lapmaster machines used for lapping aluminum parts.*



It is noteworthy that numerous variations of the familiar Kingsbury multiple-head, multiple-spindle machines are employed exclusively for certain major operations on all valve bodies. This includes such detail operations as drilling and tapping of all holes; and boring and reaming of all valve bores.

A variety of Heald special machines are used for fly-cutting the faces of valve bodies and valve plates. Typical of these, as illustrated, is the machine equipped with a trunnion fixture in which small parts are loaded on both sides.

An impressive group of the familiar Crane Lapmaster 48-in. machines are interspersed throughout the department for lapping the mating faces of valve bodies and valve plates.

A number of large, multiple-head special Ex-Cell-O machines, as illustrated, are tooled for handling all operations on the regulator body. This includes the facing of both sides by means of a milling head attachment; boring the large diameter hole; and numerous drilling and tapping operations.

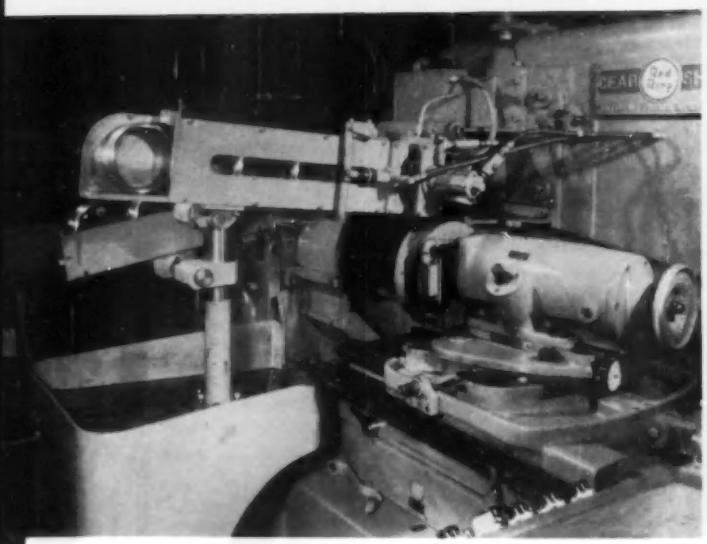
The transfer plate—a long and extremely slender part honeycombed with oil passages, is ground on both sides in a Bealy surface grinder. Then it is honed in a Micro-Hone machine for a fine surface finish as well as the requisite flatness.

Finally, we emphasize another Kokomo "first," an installation of the first two Red Ring internal gear shavers on the annulus gear line. This gear shaver,

*Left—One of the Ex-Cell-O multi-head machines on regulator body line.*

*Below — Large, double-end Besly grinder which is employed for grinding both sides of transfer plates.*

*Below—New automatic Red Ring gear shaver on internal annulus gear is equipped with automatic loading and unloading. Loading chute is in foreground; unloading chute behind it. The swinging fixture operates between the two chutes.*



at the time this article was prepared, was the first known example of completely automatic operation of an internal gear shaver on a fully mechanized line. It has automatic loading and unloading which will be connected to the Lamb automation mechanism now linking the entire annulus gear line.

As illustrated, the Red Ring shaver has two feed chutes—one for loading; the other for unloading. The wheel head is of infeed design. In the center of the machine is a pivoted arm which moves in a timed cycle to receive a gear blank from the feed chute; and eject a shaved gear into the unload chute. In operation the arm holds two pieces at any time: one is shaved, the other ready to shave.

Besides being fully automatic in action without any operator attention, these shavers are distinctive in having a floor to floor time of only 50 seconds for this extremely fussy operation.

Returning to the Webb power-and-free conveyor system, it is of interest that while it resembles the system supplied earlier for the Indianapolis PowerFlite plant, it embodies some noteworthy improvements. Retarding conveyors have been employed for controlling the flow of loaded and empty carriers along free tracks. Their function is to prevent excessive bumping and swinging, thus eliminating the effect of such action on the stop and feeders as well as the carriers. This is accomplished by reducing the tendency of the carrier to roll under gravitational forces until it reaches the bank of carriers at the head of the retarding conveyor. Although the conveyor continues to move at this point, the loads stop and are banked bumper to bumper waiting for the signal to move.

The selection switches installed on the carriers are of three-position mechanical type rather than the electrical dial selectors used formerly. The conveyor system is of heavy-duty type in keeping with the dynamic loading. For example, the transmission assembly alone weighs some 150 lb while the carrier, free trolley, and bumper assembly account for an additional weight of about 200 lb.

As is customary, the operation of the entire power-and-free system is controlled from a central board, illustrated on page 65.

*This is Part III of a three-part article devoted to the Chrysler transmission plant in Kokomo, Ind.*

# Anti-Tank Vehicle Combines Firepower and Maneuverability

THE first production model of Ontos (see AI, Sept. 15, 1955), a new anti-tank vehicle developed by Allis-Chalmers Manufacturing Co., has been accepted by the Marine Corps.

Marine Corps officers say that the new weapon has more firepower than any other land combat vehicle in history. Its main armament consists of six 106-mm recoilless rifles, which can be fired singly, in pairs, or in a six-gun salvo. It also mounts four .50 caliber spotting rifles and one .30 caliber machine gun. It carries a three-man crew—driver, gunner, and ammunition loader.

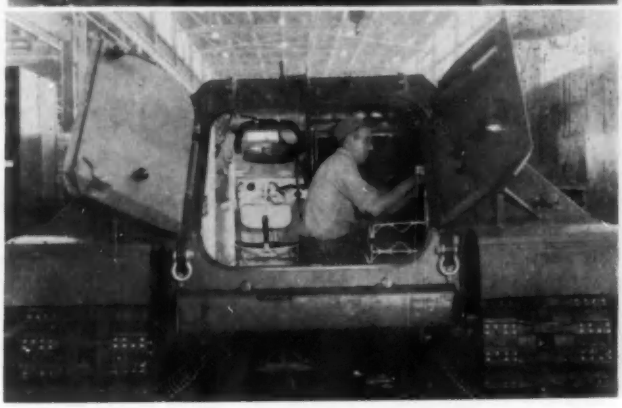
Ontos resembles an Army tank, but is lightly armored—it weighs only 8½ tons. It is fast (about 30 mph) and highly maneuverable, however, and is ideally suited for hit-and-run tactics. It is powered by a 145-hp, six-cylinder, water-cooled gasoline engine built by General Motors Corp. The transmission, another GM product, is bolted directly to the engine.

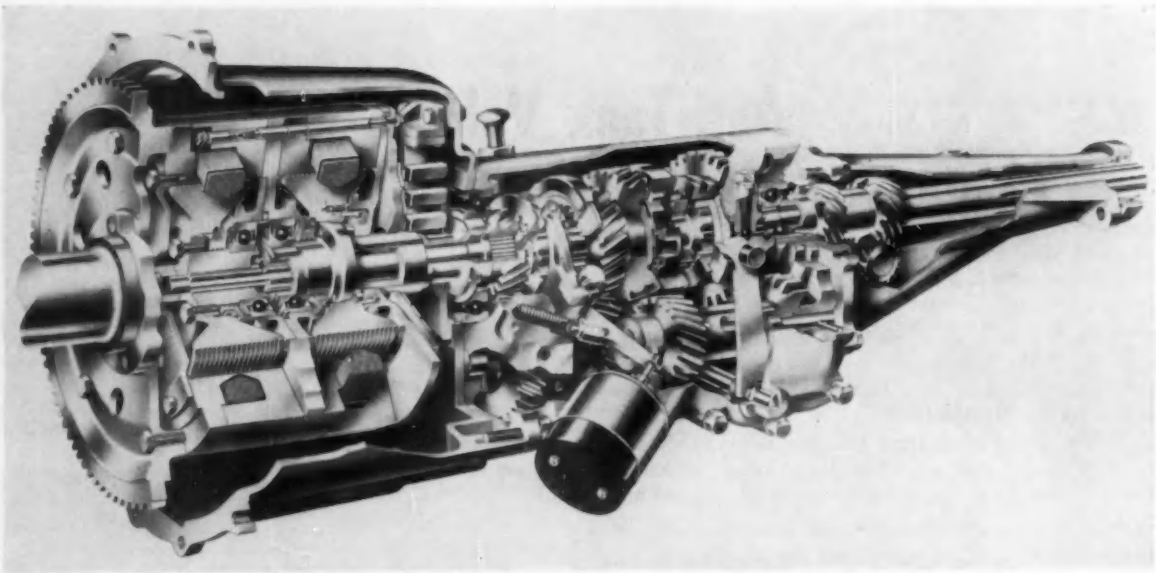
Allis-Chalmers will build several hundred of the new vehicles at its La Porte plant for both Army Ordnance and the Marine Corps. The company says that parts are being supplied by a total of 370 firms, most of them in the small-size category.

**MAJOR SUPPLIERS OF PARTS FOR ONTOS**

**Nu-Tool Corp. (Steel Fabricator)**
**Pioneer Tool & Engineering Co. (Hydraulic System)**
**Rockford Screw Products Co. (Screws)**
**Royal Rubber Co. (Rubber Parts)**
**Schwitzer Corp. (Fans)**
**Sivyer Steel Casting Co. (Steel Castings)**
**Skidmore Gear Co. (Gears)**
**Superior Steel & Malleable Castings Co. (Steel Castings)**
**Wehr Steel Co. (Steel Castings)**
**Electro-Mechanical (Electrical Equip.)**
**Allison Div. (Transmissions)**
**General Motors Corp.**
**By-Products Steel Co. Div. (Armor Plate Fabrication)**
**Lukens Steel Co.**
**GMC Truck & Coach Div. (Engines)**
**General Motors Corp.**
**Goodyear Aircraft Corp. (Fuel Cells)**
**Lukens Steel Co. (Armor Plate)**
**U. S. Rubber Co. (Rubber-to-metal Parts)**
**Young Radiator Co. (Radiators)**
**Contract Products Div.**
**National Malleable & Steel Castings Co. (Steel & Malleable Castings)**
**Amalgamated Steel Corp. (Sprocket)**
**Buchanan Steel Products Co. (Forgings)**
**Coach & Car Equipment Corp. (Canvas Fabricator)**
**Curtis Metal Products Co. (Tools & Production Machining)**
**Donaldson Co., Inc. (Air Cleaners)**
**Electric Auto-Lite Co. (Wiring Harness)**
**Kaydon Engr. Corp. (Turret Race Bearing)**
**Kendallville Foundry Div. (Iron Castings)**
**Flint & Walling Co., Inc.**
**Milsco Mfg. Co. (Seat Assemblies)**
**W. D. Sullivan Co. (General Manufacturing)**
**Hubbard & Antisdel (Art & Printing Work Cataloging)**

*Front view of Ontos shows its low overall height. Bottom illustration shows rear view of the anti-tank vehicle. A feature is the compact hull interior*





*Cutaway view of the Autoselectric transmission, showing the two magnetic clutches, the three-speed gearbox, and the solenoid for gear selection between the first and second ratios.*

# British Automatic Transmission

**By David Scott**

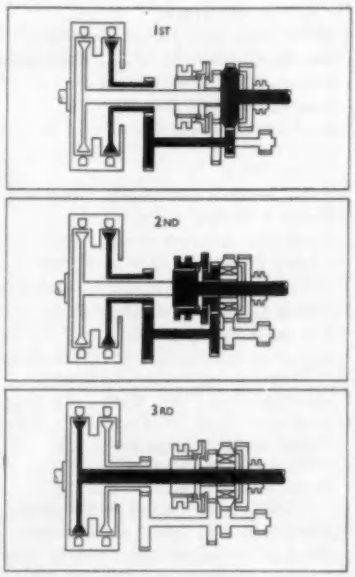
HOLDING exclusive patent rights outside North America on the Eaton electromagnetic clutch (see AI, March 1, 1954), S. Smith & Sons, Ltd., has developed the Autoselectric transmission based on this unit. While the principle is similar to the American design, it has been adapted for use in lower-powered European-type cars.

The forward part of the assembly comprises two magnetic clutches whose driving members are permanently coupled in tandem to the engine crankshaft. The driven elements are carried on separate coaxial shafts leading back to the transmission, the first for direct drive and the second for the two indirect ratios.

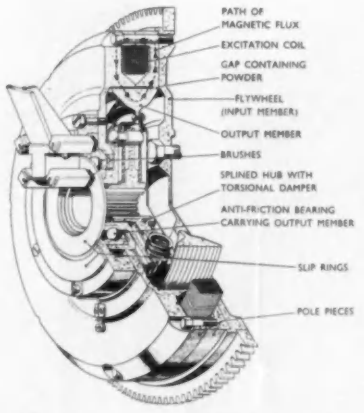
Clutch take-up is effected by passing an electric current through the excitation coil to create a magnetic flux. This action solidifies the ferrous powder contained in the annular gap between the rotating input and output elements, and mechanically freezes the two units together. Timing of the current applied to the coils is controlled by a relay system sensitive to both throttle position and road speed, so that switching and selection are automatic.

While the first clutch drives the mainshaft of the transmission, the second is geared to the countershaft, which carries the first and second speed pinions. These are in constant mesh with their respective speed gears, which are free to rotate on the mainshaft.

A manual selector with three positions—forward, neutral and reverse—controls all functioning. When the selector is moved to the forward position the first speed gear is coupled by an overrunning clutch to an annular ring, which is locked solid to the mainshaft




*Power flow through the transmission in each of its three gears.*



***Details of the magnetic clutch unit. Illustration at right shows components of the magnetic clutch unit which include the flywheel, driving or input member containing the magnetic coil, and the driven member splined to the shaft leading to the gearbox. The brushes contact collector rings on the input side.***

# Developed from Eaton Magnetic Clutch

by a dog clutch. Thus, the first gear drive is through the second dog clutch to the countershaft, thence through first speed gears and the overrunning clutch to the output shaft, via the dog clutch.

As road speed increases a solenoid selector locks the second speed gear to the mainshaft, causing it to rotate faster than it would be turned by the first gear. The second speed gear then transmits the power, since the internal overrunning clutch in the first speed gear enables the latter to idle. Instead of synchromesh, a simple baulk ring is used to prevent second gear engagement until the speeds of the two mating parts are the same. This synchronization is supplied by momentarily engaging the front clutch to reduce engine speed.

For the shift to direct drive, the solenoid disengages second while the first clutch for direct drive is simultaneously excited. Downward gear changes are carried out in the reverse sequence with the reverse gear being engaged manually; the dog clutch locked in the first gear operation also carries a reverse gear pinion which can be slid into engagement.

Ratio selection are governed by an electrical switching device having a permanent magnet current coupling as the speed sensitive element, with a mechanical linkage to the throttle to modulate the speed settings progressively according to throttle opening. Electrical signals from this brain operate relays in the clutch-energizing circuit. The built-in hysteresis of the governor causes downshift speeds to be lower than upshift speeds—a required feature of an automatic transmission.

High mechanical efficiency and an ability to shift gears under power with uninterrupted traction are claimed to be major features of this system.

• • •

### *Lindberg Aluminum Furnaces To Go in New Ford Ala. Plant*

Ford Motor Co. has awarded Lindberg Industrial Corp., a contract for 14 gigantic field-erected aluminum reverberatory type furnaces. They will handle the annual contemplated requirements of 64 million lb of aluminum at the new Ford permanent mold and die casting plant in Sheffield, Ala.

The majority of the furnaces will each have a holding capacity of 65,000 lb of molten aluminum as received in special mobile carriers from the nearby Reynolds primary metal plant. The common practice of felting pigs of aluminum is thereby avoided.

The new facility will enable Ford to keep pace with the overall expansion requirements with the increasing use of aluminum for automotive parts. The plant will contain 200,000 sq ft of floor space and will employ 800 persons.

# Latest Equipment Displayed at Metal Finishing Show

APPLICATIONS of coated abrasives in the automotive industries were illustrated and demonstrated at the Metal Finishing Show staged in Cleveland by Behr-Manning Co. last month. At the show, the second of its kind held by the company, manufacturers of equipment using coated abrasives put on display the machines used for metal finishing, and showed some of the kind of work done. Behr-Manning Co. at the same time gave its visitors some illustrations of the progress in the coated abrasives themselves.

Coated abrasives, in which abrasive grains are bonded to a sheet material such as cloth or paper, would have meant "sandpaper" thirty years ago. Even as recently as 15 years ago, when synthetic abrasives were becoming important, most work with coated abrasives was hand work. Within the past 10 years, and more especially within the past five, coated abrasives have begun to find wider use in precision finishing, and in mechanized processes.

The coated abrasive is today used in the form of (1) a disk, which may have a backing of any degree of hardness from that of sponge rubber to metal; (2) a belt, single or multiple, and used as a free belt, without backing at the point of contact with the work or as a supported belt, with a contact wheel or a platen backing at the contact point; (3) a fixed covering over a rotating drum or wheel, or reciprocating pad, and (4) a loose covering, as in the air-inflated grinding wheel. The work itself may be hand-held, as in off-hand polishing or grinding, or positioned by a fixture or other device. As in other lines of manufacturing, there is a strong trend toward mechanization of processing with coated abrasives, and some processes have been fully automated.

The possibilities of coated abrasives for polishing metal parts having difficult contours are beginning to be recognized. An example of this is the cleaning and polishing of an aluminum wheel for a deluxe passenger car. The areas between the spokes was impossible to reach with any of the bonded abrasive wheels without the danger of marring the surface of the piece. Hand cleaning would be very costly. The answer was found in a specially designed machine using a coated abrasive belt, which cleaned and polished the areas between the spokes quickly and safely. (Fig. 1)

The matter of polishing areas difficult of access has been pointed up by the streamlined styles of present-day cars. Gracefully curved steel bumpers on a luxury car provided a problem in cleaning up the metal by machine without damaging the surface. Another specially built belt grinder provided the answer to

FIG. 1

*A new Bush swing sander which permits the contact wheel to be raised or lowered*

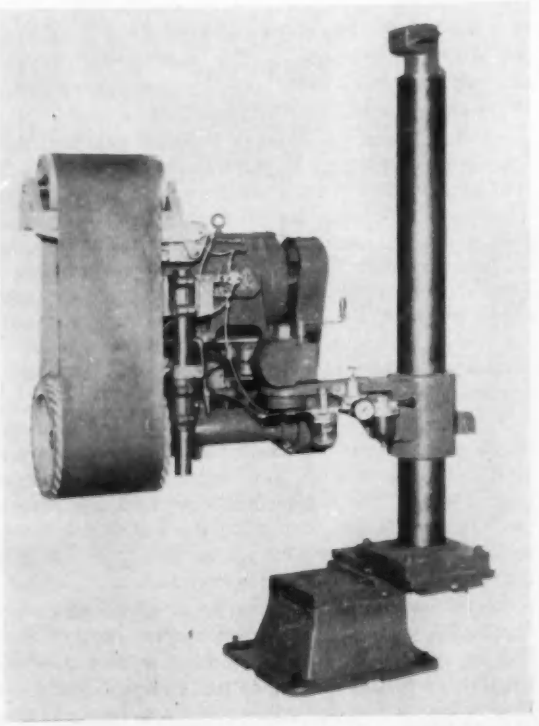


*FIG. 2—Special Acme 12-in. belt head incorporating air tensioning*

this one, with a serrated contact wheel to provide the right degree of backing for the abrasive. (Fig. 2)

The pin bearing walls of a Diesel engine crankshaft must be polished to remove scratches and burrs, and a light portable tool that can be taken to the work is indicated. The answer is found in a rotor tool in which a coated abrasive drum does the polishing. (Fig. 3)

Present technique in the production of bumpers is to polish the stock in the flat, and then to form and plate the polished steel. In the installation shown, especially built to handle bar, strip, tube, or extruded stock, six units are placed in tandem. Each unit has two wheels, which may be buffing wheels or wearable coated abrasive wheels. Any required number of units may be used together. (Fig. 4)

Another straight-line coated abrasive polisher for strip stock uses vertical pinch-roll grinding, wet or dry. The abrasive belts may be as wide as 60 in. if the work requires. Nine units are shown in tandem. (Fig. 5.)

The polishing of turbine blades for jet engines is a close-tolerance operation in which the contours of the blade surfaces cause difficulty. Especially difficult are the surfaces at the base of the blade, where the base fillet blends into the blade contours. Polishing is now done off-hand on a belt polisher with a special polishing head. To provide the soft backup for the abrasive belt and eliminate the danger of nicking, a napped fabric belt runs inside the loop of the abrasive belt. The ¾-in. abrasive belt is carefully controlled in tracking by lateral adjustments. Belt speed is 2800 sfpm. (Fig. 6.)

A polishing wheel consisting of many thin, flexible leaves of coated abrasive is an excellent device for polishing a grooved plate of the type shown. (Fig. 7.)

The headlight ring, door handles, escutcheons, stone shield, and trim strips are other examples of die cast automotive parts for which rapid clean-up is accomplished on narrow width belt machines by free belt polishing.

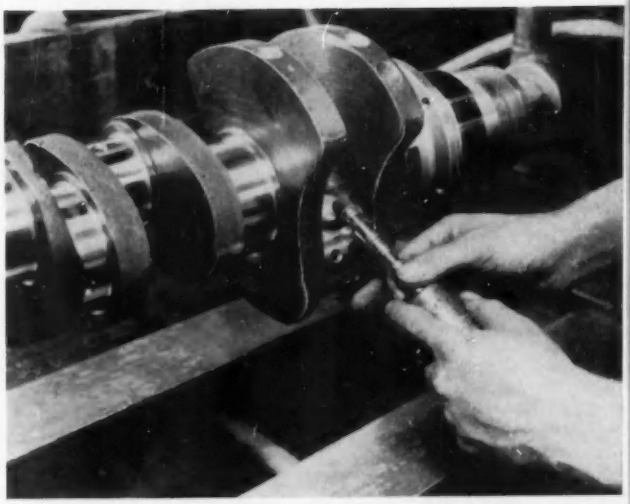


*FIG. 3—Removing scratches on Diesel engine crankshaft with Rotor Tool unit*

Automobile body assembly makes use of coated abrasives for clean-up operations. Again, streamlined body styles have made necessary the smooth seamless appearance of pieces joined into compound curved surfaces. On station wagons and trucks of a leading manufacturer, quarter panels at the rear of the roof are welded into place, and the weld is then cut off by grinding with a coated abrasive grinder. This permits blending the curves of the new piece into the body

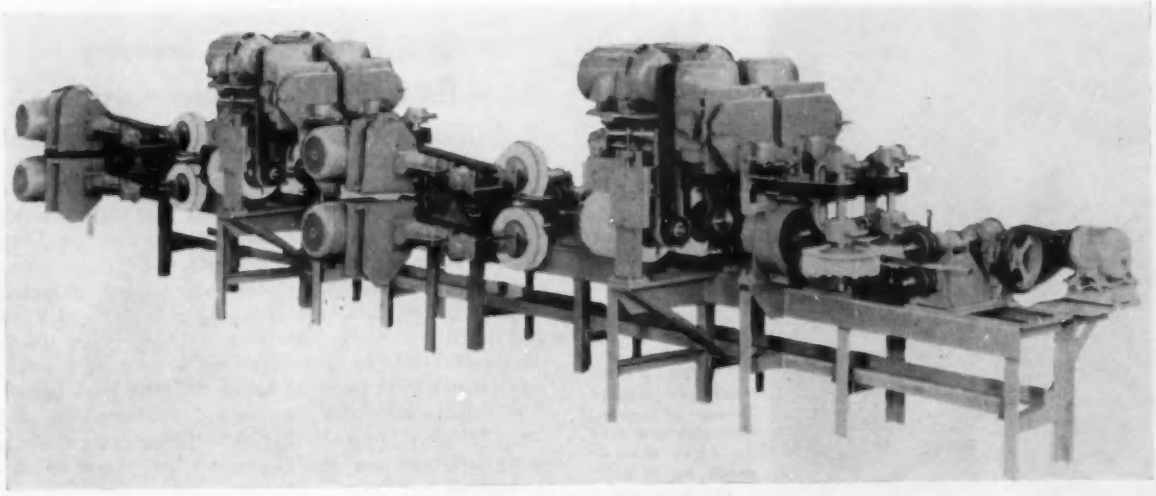


*FIG. 4—Murray-Way longitudinal polisher*

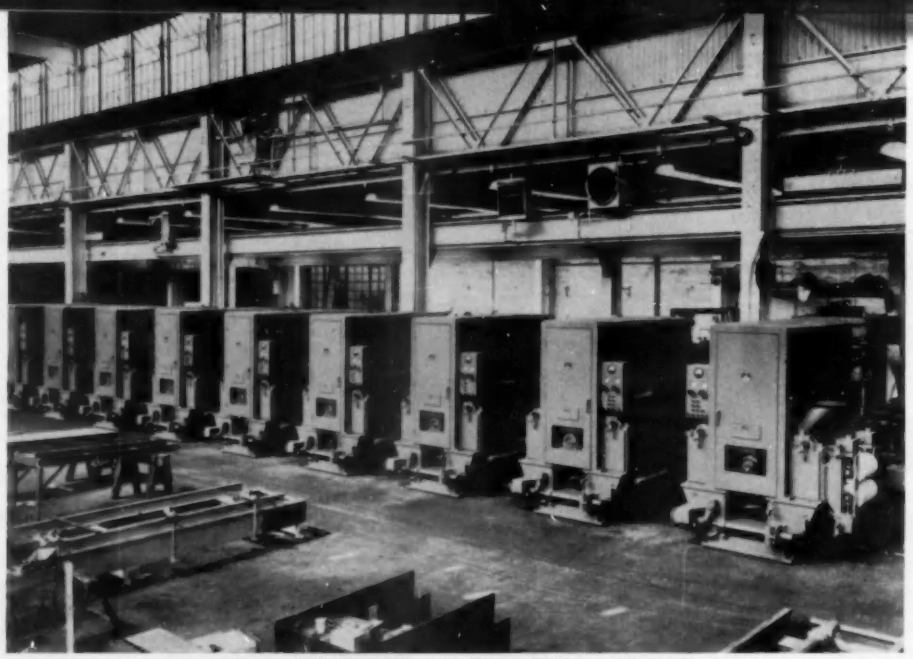


FIG. 5—Hill Acme straight line polishing equipment

FIG. 6—Bader Space Saver with special head

FIG. 7
Many thin, flexible leaves of coated abrasive are used in this wheel made by Marit Products, Inc.

curves, without biting into the sheet metal. The grinder is overhead suspended so as to reach the roof seams easily.

Joining the back fender into the quarter panel on a passenger car brought a somewhat similar solution. The seam was first soldered to produce a continuous metal surface, and the seam line was then cleaned off with an abrasive grinder. A special head was used for this operation to give access to difficult areas.

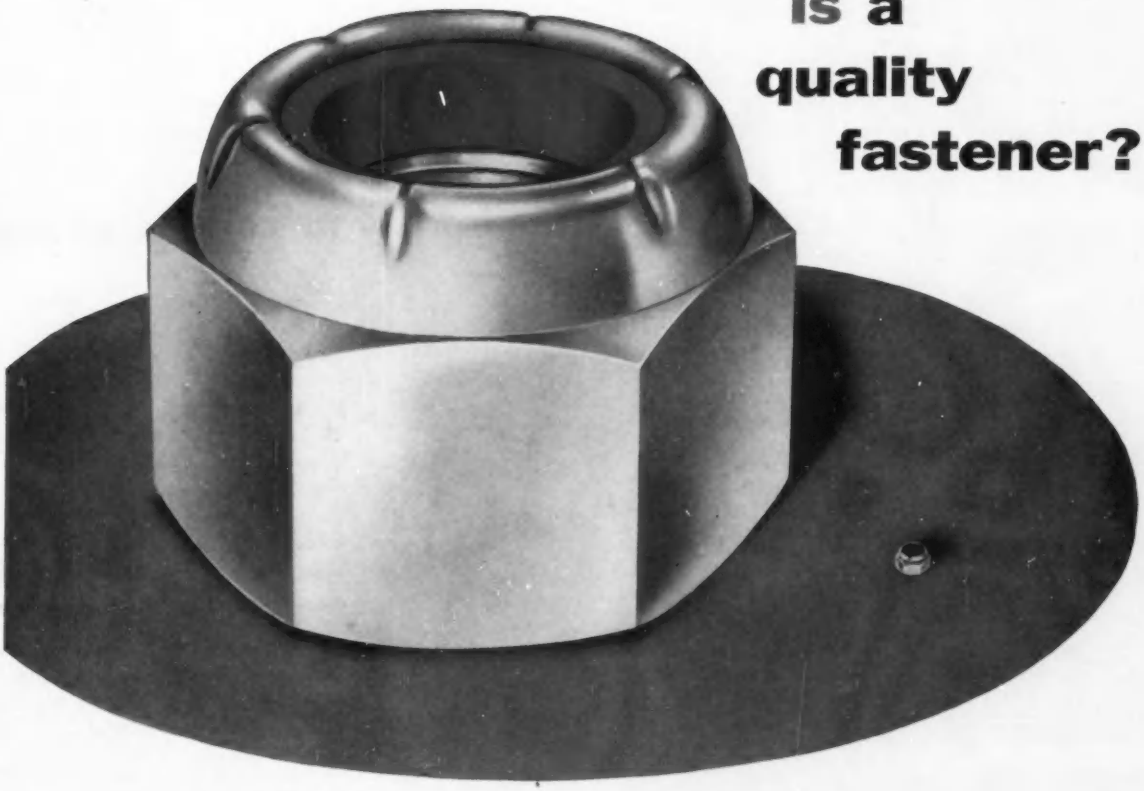
Smoothing down the entire automobile body when applying the finish is another application for coated abrasives in one of the plants producing a quality car. The color coat is sanded down with a disk sander, using a very soft backup wheel of sponge rubber, a fine paper disk of 360 A abrasive, and oleum spirits.

• • •

## British Automobile Industry Hit Severely by Suez Crisis

Closing of the Suez Canal has dealt a heavy blow to the British automobile industry. Gasoline rationing in Britain, on top of the existing squeeze on consumer credit, is causing the home market to shrink drastically. Fuel cuts in Continental Europe have curbed sales to that area. Exports to overseas countries are hampered by the aggravated shipping shortage. Production is dropping sharply, and Ford has been forced to introduce a short work week. Vauxhall (GM) is operating only four days a week, and output is 25 per cent below the 1956 peak figure. The Rootes Group is also on a four-day week, and lay-offs are planned. Other manufacturers are similarly affected, as are the many suppliers to the industry.

# What size is a quality fastener?



Here are two ELASTIC STOP® nuts.
Each has the familiar red locking collar. Each is self-locking, vibration-proof and can be reused many times. Each is a fast, readily assembled one-piece unit . . . will maintain accurate adjustment anywhere on a bolt. Each will afford positive protection against thread corrosion . . . prevent liquid seepage along bolts. Each is manufactured in quantity. Each is exactly controlled as to quality of raw material, finished dimensions, class of thread fit, seat squareness and finish. Each has a record for precision and uniformly high performance that is unmatched.

But . . . one measures 1/10 inch across the flats; the other, 4 inches. Between these two, there are more than 530 different hex nuts in the ESNA line. They are the result of variations in height, material, finish and size.

Look to ESNA for the top quality self-locking fastener that fits your need best.

## ELASTIC STOP NUT CORPORATION OF AMERICA

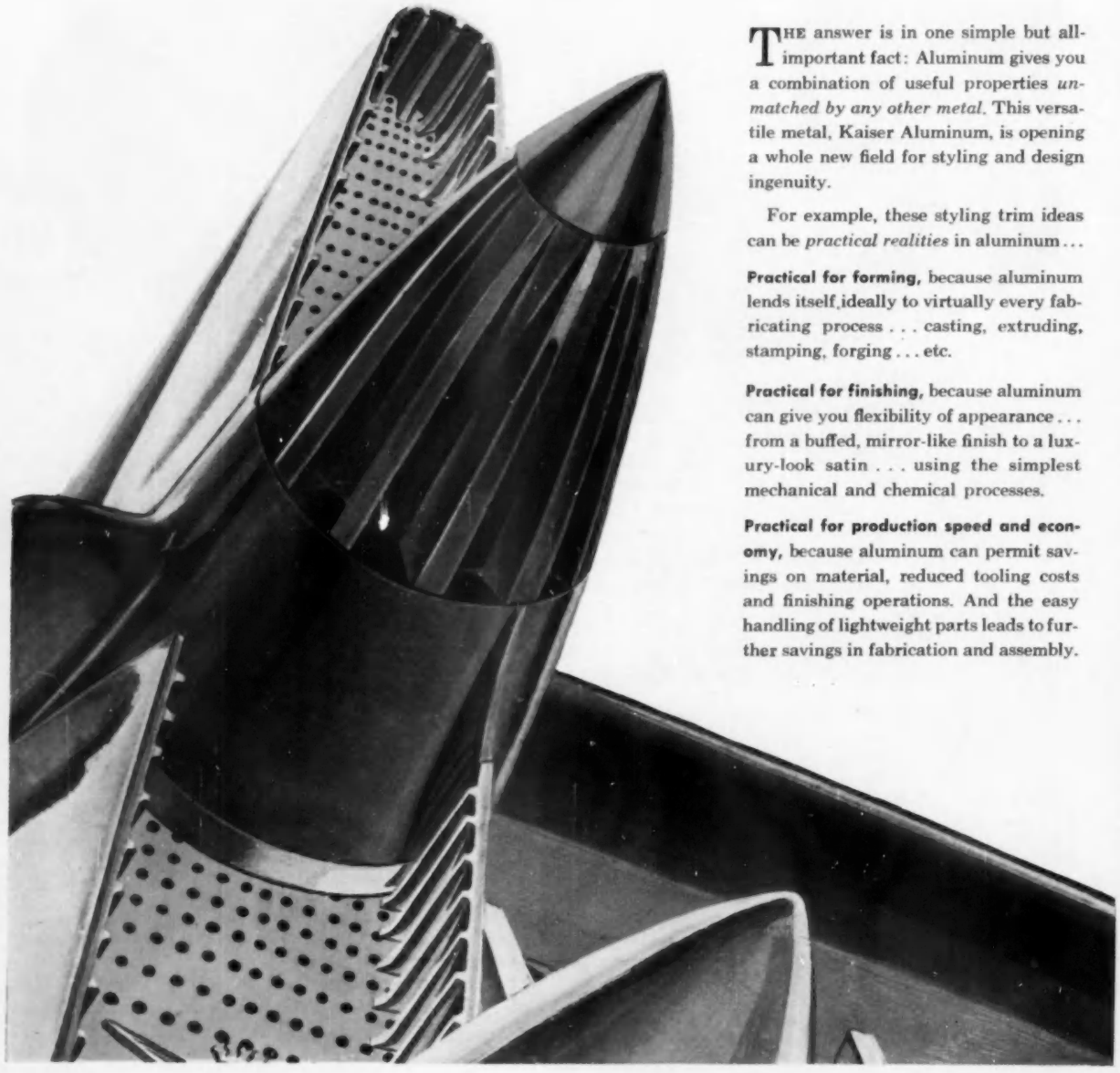
ESNA® TRADE MARK / ROLLPIN TRADEMARK

**Elastic Stop Nut Corporation of America**
**Dept. N58-125; 2330 Vauxhall Road, Union, N. J.**
Please send the following free fastening information:

☐ ELASTIC STOP nut bulletin ☐ Here is a drawing of our product. What self-locking fastener would you suggest?

Name_____ Title_____
Firm_____
Street_____
City_____ Zone____ State____

# How can aluminum help you style and sell



THE answer is in one simple but all-important fact: Aluminum gives you a combination of useful properties *unmatched by any other metal.* This versatile metal, Kaiser Aluminum, is opening a whole new field for styling and design ingenuity.

For example, these styling trim ideas can be *practical realities* in aluminum...

**Practical for forming,** because aluminum lends itself ideally to virtually every fabricating process . . . casting, extruding, stamping, forging . . . etc.

**Practical for finishing,** because aluminum can give you flexibility of appearance . . . from a buffed, mirror-like finish to a luxury-look satin . . . using the simplest mechanical and chemical processes.

**Practical for production speed and economy,** because aluminum can permit savings on material, reduced tooling costs and finishing operations. And the easy handling of lightweight parts leads to further savings in fabrication and assembly.

## *tomorrow's car?*

And — again through this unique combination of *properties* — aluminum provides extra benefits that can be used as sales advantages . . .

**Lasting beauty,** solid aluminum, with no plating to chip, wear or peel.

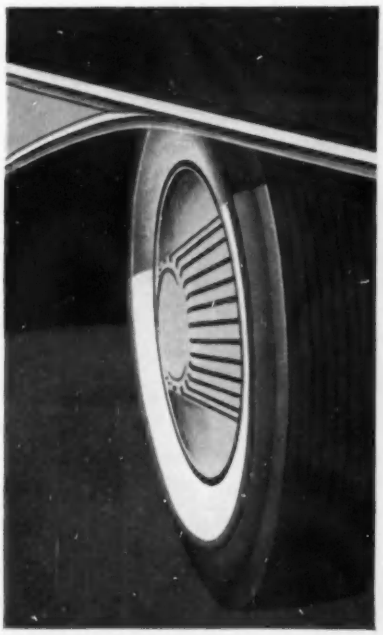
**Rust-proof,** corrosion resistant.

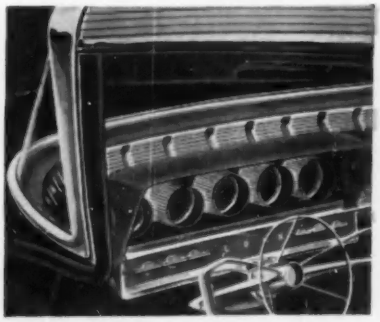
**Easy to maintain,** "new look" for the life of the car helps boost trade-in value and lowers reconditioning costs.

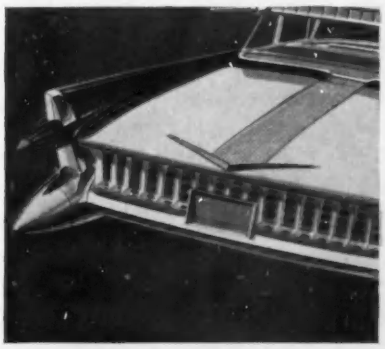
Our Automotive Development engineers are available to work with you as "idea partners" . . . introducing new developments such as Kaiser Aluminum's exclusive, *sunfast* gold-color aluminum alloy . . . as well as to help you on any specific requirements and problems in aluminum alloy selection and fabrication.

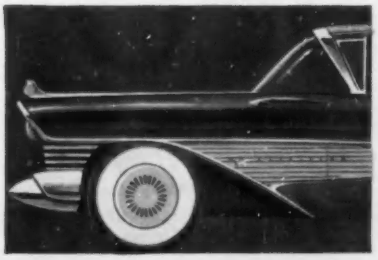
For further information, call our Automotive Industry Division, TRinity 3-8000, Detroit. Kaiser Aluminum & Chemical Sales, Inc., 2214 Fisher Bldg., Detroit 2, Michigan.

**See "THE KAISER ALUMINUM HOUR." Alternate Tuesdays, NBC Network. Consult your local TV listing.**

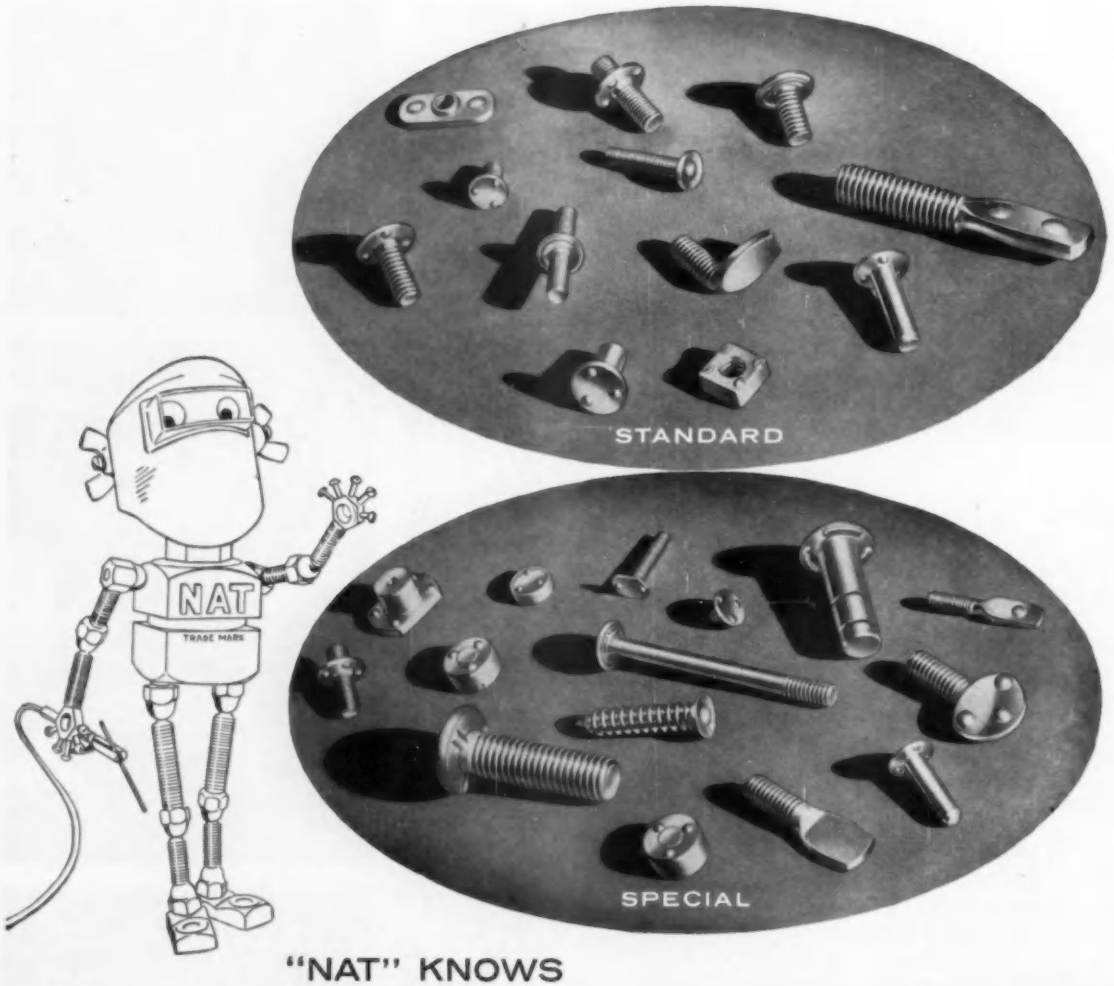








**Kaiser Aluminum**




"NAT" KNOWS

# WELDING FASTENERS

Standard or special, "Nat" can tell you all about projection welding fasteners. National's complete, high quality line of standard weld screws, pins and nuts gives you maximum strength and 100% optimum welds . . . even on materials .030 to ¼ inch thick.

Bring your welding fastener problems to National. Besides offering a satisfactory solution, we will design any *special* welding fastener you may need.

Write for *National Welding Fasteners* catalog. It shows "Nat's" complete welding line.

**THE NATIONAL SCREW & MFG. COMPANY**
**CLEVELAND 4, OHIO**
*Pacific Coast:* National Screw & Mfg. Co. of Cal.
3423 South Garfield Ave., Los Angeles 22, Cal.

National PRODUCTS

Fasteners Hodell Chains Chester Hoists

# "Two Clark planetary axles make this truck an ideal drift-bucker"

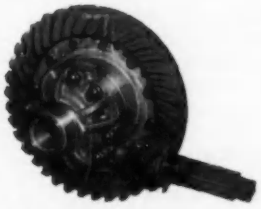
*.....Hydro-Quebec*

For transporting equipment cross-country, through northern Quebec's heavy snows to a new power development, Hydro-Quebec converted trucks of conventional type to four-wheel drive by installing Clark Power Trains—torque converter, transmission and two Clark planetary axles, one steering and the other non-steering. "Excellent equipment—doing a great job," says Hydro-Quebec.

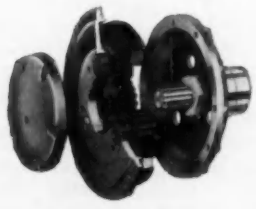
Clark's planetary axle has established an extraordinary performance record in extremes of punishing service—a record high-lighted by the virtual elimination of broken axle shafts.

In this revolutionary axle 70 percent of the driving torque is transferred to the planetary assembly in the drive-wheel—in contrast to conventional design, in which the full torque load is delivered directly to the axle shafts. Shaft wind-up and surge are practically eliminated, and broken shafts virtually unknown. Power flows smoothly—no chatter, no "digging" in soft ground. Also, by means of better torque-load distribution, this axle combines maximum rugged strength with minimum size and weight.

Are you looking for ways to improve your machines?—to get more work done? Get acquainted with this new axle that outlaws broken shafts. A helpful bulletin provides full information—use the coupon.



**Primary Reduction** in the center section, by helical bevel pinion and gear.



**Second Reduction** in the drive wheel—a sun gear splined to the axle shaft and three planet gears driving an internal gear in the inner periphery of the wheel, as close as possible to the point where tractive effort is applied.

Two types: steering and non-steering.

**CLARK EQUIPMENT COMPANY • AXLE DIVISION, Buchanan 2, Michigan**

CLARK® EQUIPMENT

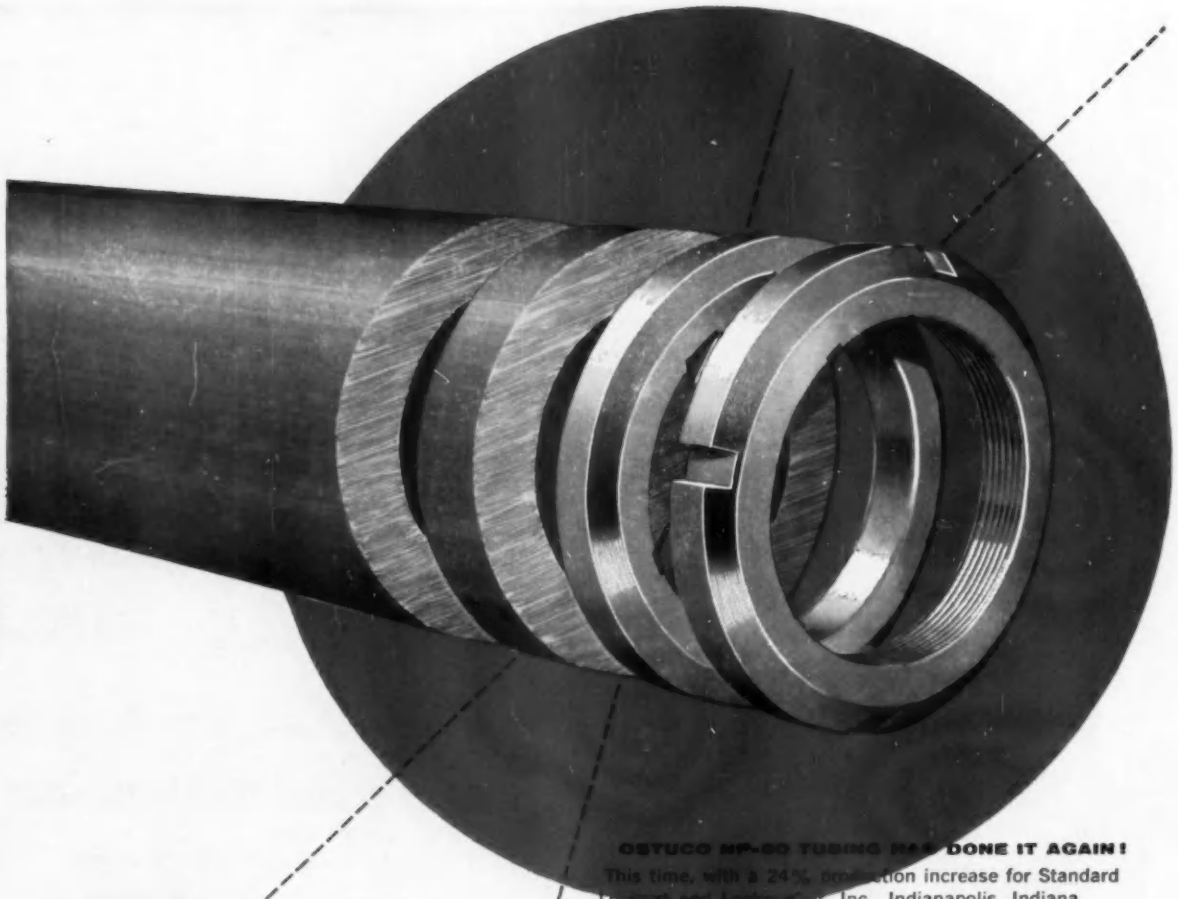
Please send illustrated bulletin on the Clark Planetary Axle.

Name_____ Position_____

Firm_____

Address_____

City_____ State_____



**24% Production increase at Standard Locknut & Lockwasher, Inc. after switching to OSTUCO NP-60 tubing**

**OSTUCO NP-60 TUBING HAS DONE IT AGAIN!**

This time, with a 24% production increase for Standard Locknut and Lockwasher, Inc., Indianapolis, Indiana. Tubing experts from OSTUCO recently recommended a switch to NP-60 Tubing specially processed for machineability for Standard's locknut and lockwasher line used in ball and roller bearing applications.

Standard components find their way into electric motors, machine tools, automotive, aircraft, farm and construction equipment. Other companies, with equally diverse applications, report similar success with NP-60. If you are machining bearings, washers, collars, or any circular part, you'll do well to check into the merits of OSTUCO's new NP-60 seamless steel tubing.

**GET NP-60 WITH "SINGLE-SOURCE SERVICE."**

New NP-60 seamless tubing comes to you with OSTUCO'S unique "Single-Source Service"—experience and facilities for design and development, production and delivery all under one roof. Get together with a tubing expert for preliminary planning on NP-60's possibilities in your product. Contact your nearest sales office or write direct to the factory.

OSTUCO SHELBY, OHIO

# OSTUCO TUBING

SEAMLESS AND ELECTRIC RESISTANCE WELDED STEEL TUBING—Fabricating and Forging

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of Copperweld Steel Company • **SHELBY, OHIO**
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**CANADA,** RAILWAY & POWER ENGR. CORP., LTD.

**EXPORT:** COPPERWELD STEEL INTERNATIONAL COMPANY 225 Broadway, New York 7, New York

# News of the MACHINERY INDUSTRIES

*By Thomas Mac New*

Machine Tool Builders Elect New Officers at 55th Annual Meeting. National Bureau of Standards Develops Comparator for Accuracy to Ten Millionth Inch.

*Jerome A. Raterman, President-Elect of NMTBA*

*Tell Berna, Executive Vice President of NMTBA officially retires Feb. 1, 1957*

*Ludlow King, Executive Vice President-elect who will take over as executive head of the NMTBA*

## Annual Meeting of Tool Builders

Billion dollar years are ahead for builders of machine tools, according to Louis Polk, president of Sheffield Corp., and President of the National Machine Tool Builders' Association. This prediction was made at the 55th Annual Meeting of the NMTBA which was held in Chicago recently. Volume of the industry has increased in the last five years twice as fast as the growth of the national economy. The meeting marked the retirement of Executive Vice President Tell Berna, guiding light of the association for 20 years.

Mr. Berna officially retires from the NMTBA Feb. 1, 1957. During his tenure of office, this country has seen the most teriffic machine tool show—1955—ever held on this continent. He played a major role in creating a much more dynamic and progressive industry.

New officers elected for the 1957 term are: President—Jerome A. Raterman, president, Monarch Machine Tool Co.; First Vice-President—Alfred V. Bodine, president and treasurer, the Bodine Corp.; Second Vice-President—Ralph J. Kraut, president of the Giddings and Lewis Machine Tool Co.; Perrin C. March, III, president of the Cincinnati Shaper Co., was re-elected Treasurer; Walter K. Bailey, president of the Warner & Swasey Co., was elected Secretary.

New Directors elected were Mr. Kraut, Mr. Bailey, and Edwin R. Smith, president and treasurer of the Seneca Falls Machine Co.

Ludlow King, Assistant Vice-President of the Association, was elected Executive Vice-President, succeeding Tell Berna.

## Gage Block Comparator

The National Bureau of Standards has developed an interferometric comparator that makes routine comparisons of length to the nearest ten-millionth of an inch. Designed by T. R. Young and J. B. Saunders of the Bureau's engineering metrology laboratory, the extremely precise instrument will be used to check lengths of industry's master gage blocks which control the tolerances of mass-produced machine parts.

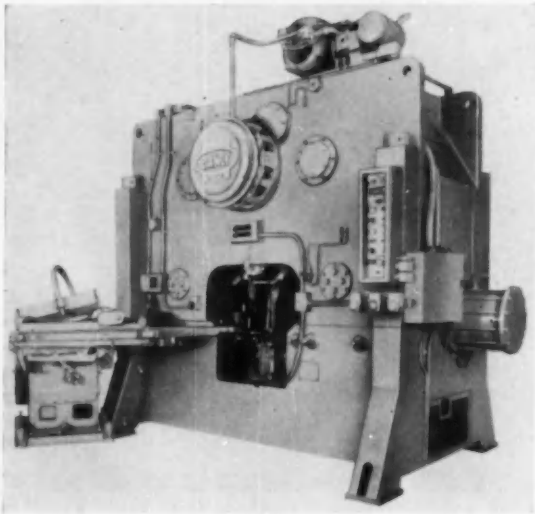
At present the Bureau calibrates master gage blocks to an accuracy of one part in a million, that is, to the nearest millionth of an inch for inch-long blocks. However, the use of continually smaller tolerances in industry caused manufacturers to request that the Bureau develop procedures for calibrating their master gage blocks on a routine basis to one part in ten million. Because of the extreme importance of this work, the Congress provided a substantial increase in the Bureau's appropriation, specifically requesting increased effort on the project. Ten major industrial firms also made available a grant of $19,500 per year for three years so that the necessary research could be carried out as soon as possible.

(*Turn to page* 146, *please*)

# NEW PRODUCTION and PLANT EQUIPMENT

*FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89*

## Machine Extrudes Piston Pins at High Rate



*This special 100-ton mechanical press, one of two recently built, is called a dual slide extruding machine. Two slides exert the horizontal pressures required to extrude 3¼-in. long piston pins for truck engines. Operation is completely automatic. The hopper at left feeds short lengths of bar stock to the mechanism for extruding to size, including inside diameter and length. The piston pins exit in the rear area. Net productive capacity per unit is about 2500 pieces hourly. (Danly Machine Specialties, Inc.)*

Circle 30 on postcard for more data

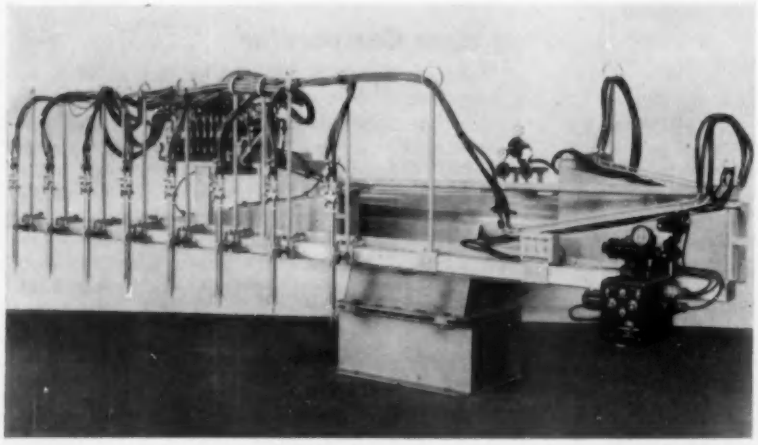
## Gas Shape-Cutting Machine

A MEDIUM-AREA oxyacetylene shape-cutting machine, the No. 56 Oxygraph, is designed to carry the latest automatic cutting equipment—motorized cutting torch holders, solenoid gas distribution system, and the electronic tracer—all remotely controlled from an "operator's station." It is capable of carrying automatic electronic welding equipment.

The machine is of the stationary type with a fixed cutting area (56 in. diam circle), but is designed for conversion to a larger-area, unlimited-length machine by the addition of rails and a traveling carriage. Electronic, manual and magnetic tracers may be used. The basic machine consists of the pantograph arms, the operating bar upon which the torches and tracer are mounted, and a welded pedestal for bolting to the floor.

Features include: all-welded steel construction; pantograph arms of box-girder design; large diameter ball bearings in pantograph arm hinges and operating bar assembly; electrically-operated solenoid-controlled gas distribution system; and electrical panel assembly with outlets for accessories. *Air Reduction Sales Co.*

Circle 31 on postcard for more data



*Airco No. 56 Oxygraph gas shape-cutting machine accommodates automatic accessories*

## Motor Generators

HIGH frequency, vertical motor generators, in a new line, have been introduced for induction heat applications such as melting, forging, brazing, annealing and hardening. Generator ratings from 10 kw to 250 kw outputs are available in frequencies of 1000, 3000 and 10,000 cycles per second. Higher kw-rated generators and other frequencies are also obtainable on request. The various voltages are obtained with tapped windings. Larger units are designed with separate generators for split output, so that a 200-kw generator, for example, could be converted to two 100-kw generators. Rapid changes of power output and improved regulation are said to be operational features of these units.

The motor generators are totally enclosed and are cooled by fin type copper tube heat exchangers. A centrally-located impeller fan distributes forced air cooling over the components. Air and bearing temperatures are held within safe limits by a thermostat. The generator also has cut-off protection for water pressure and temperature. The control box contains an hour meter, safety light indicators and an overload surge protection for generator. *Welduction Corp.*

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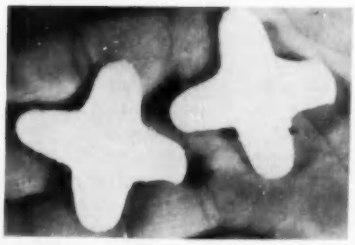
## Evaporation Barrier

As a solution to the problem of evaporation losses, a product which is said to have been specifically designed for retarding vapor formation by as much as 75 per cent is now being offered. Known as Mini-Vaps, the barriers are basically expanded polyethylene miniature floats containing tiny air cells for buoyancy and light weight. They are resistant to chemicals and solvents, as well as to puncturing and breakage in rough use. Their surface contours provide for interlocking and clustering at the surface of solutions. Nominal dimensions are ¼-in. thick by 1½ in. wide.



*Agile Mini-Vaps retard evaporation*

Suggested applications include plating tanks, cleaning and pickling tanks, solvent and oil storage, and rinse tanks. *American Agile Corp.*

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## Spot Welder for Large Aircraft Sections

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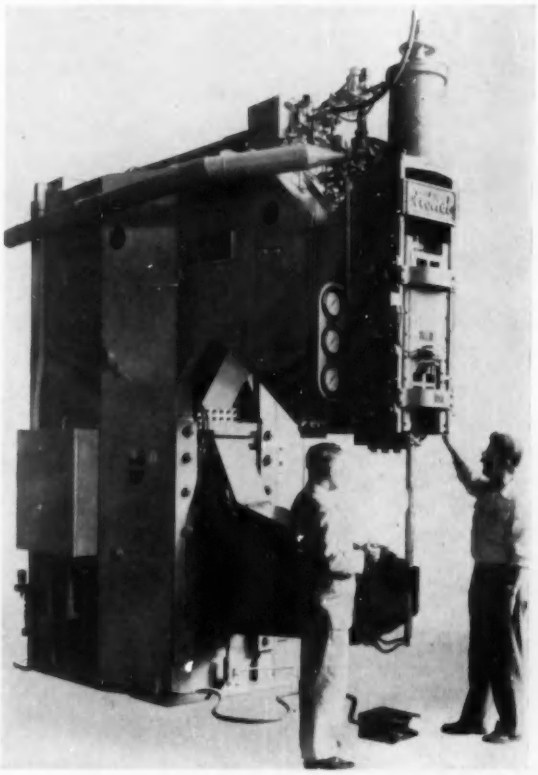
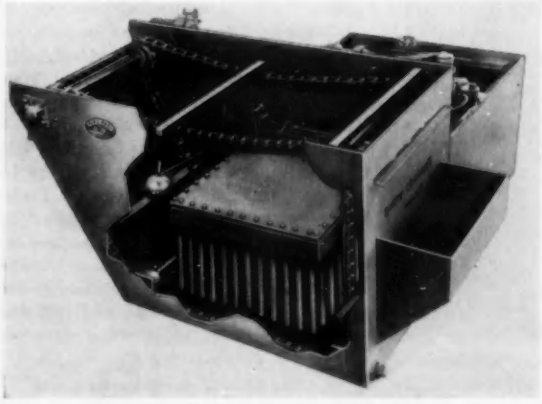


## Filter for Coolants and Cutting Oils

Designed for efficient filtration and maximum flow capacity of coolants, cutting oils and all liquids requiring removal of minute particles, the Filter-Matic filter, is said to be versatile in application and economical in operation.

Small diameter screen tubes are manifolded together into a common suction header through which the sludge-laden liquid is drawn by a special multiple chamber valve and pumped into a filtered liquid compartment. As the screen deposits reduce the liquid flow through the screen tubes, the unfiltered liquid level begins to rise. At a predetermined level, a float actuates a switch controlling the multiple chamber valve, reversing the flow of the liquid. The reversed flow backwashes accumulated deposits from the screens. As the reverse flow of clean liquid causes the unfiltered liquid to continue its rise, the float switch again reverses the flow of liquid through the valve, returning to the filtering cycle. Sludge removed from the screen tubes drops to the bottom of the filter compartment where it is removed by chain driven flights.



*Delpark Filter-Matic tubular screen type filter features small floor requirements and 5 to 1000 gpm flow capacities*

When precoat is used, an automatic measuring device, with a vibrating mechanism to prevent bridging of the precoat material, is mounted above the filter inlet and automatically feeds a predetermined amount of precoat material at each backwash period. The precoat feeding device is actuated by the air cylinder feed which operates the multiple chamber valve. This automatically adds new precoat at the same time the old precoat is backwashed from the tubes. *Industrial Filtration Co.*

Circle 35 on postcard for more data

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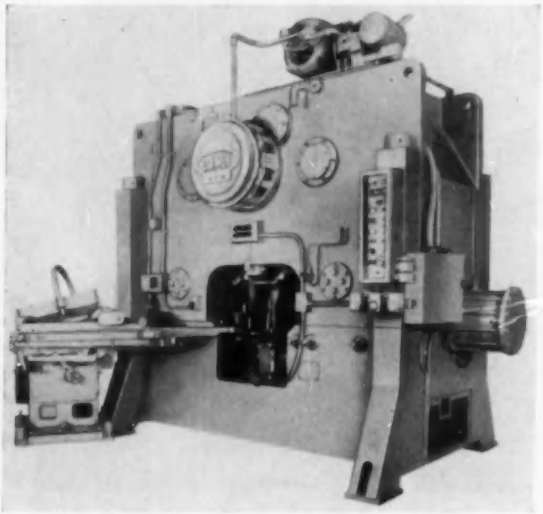

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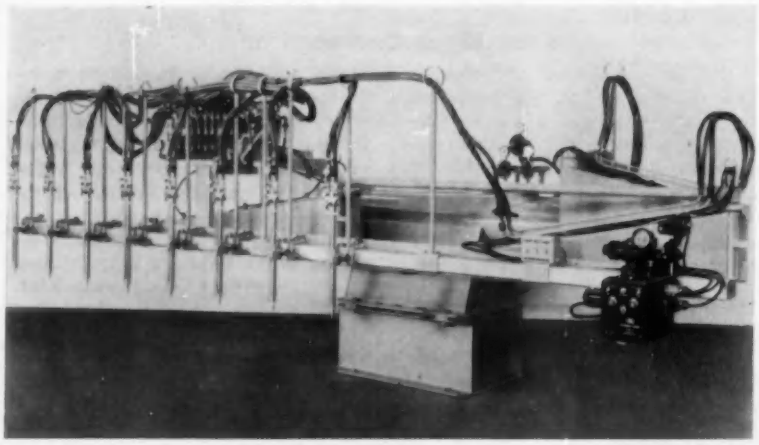

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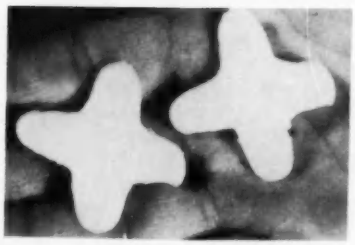

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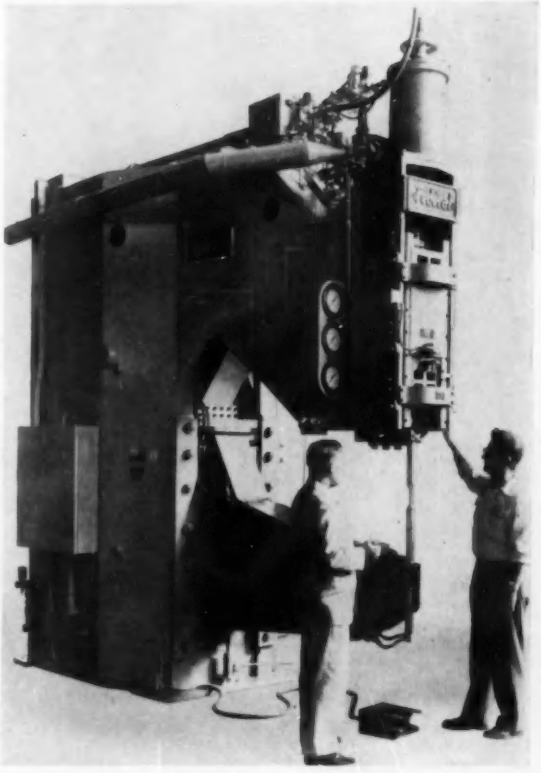
*Having a height of over 13½-ft and weighing more than 58,000-lb, the three-phase frequency converter spot welder pictured is said to be the largest resistance spot welding machine of this type built to date. It was designed with a special throat of about 2100 sq in. to accommodate a portion of the tail section of a jet airliner now under construction. The three-phase unipolar transformer, which supplies 100,000-amp of welding current, weighs more than 25,000-lb and reportedly entailed the development of new construction techniques. Features were built into the machine for producing welds meeting specifications exceeding those required by military specifications for aluminum aircraft structures. (Federal Machine and Welder Co.)*

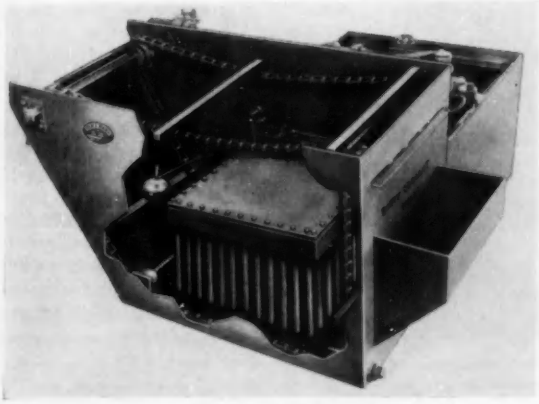
Circle 34 on postcard for more data



## Filter for Coolants and Cutting Oils

Designed for efficient filtration and maximum flow capacity of coolants, cutting oils and all liquids requiring removal of minute particles, the Filter-Matic filter, is said to be versatile in application and economical in operation.

Small diameter screen tubes are manifolded together into a common suction header through which the sludge-laden liquid is drawn by a special multiple chamber valve and pumped into a filtered liquid compartment. As the screen deposits reduce the liquid flow through the screen tubes, the unfiltered liquid level begins to rise. At a predetermined level, a float actuates a switch controlling the multiple chamber valve, reversing the flow of the liquid. The reversed flow backwashes accumulated deposits from the screens. As the reverse flow of clean liquid causes the unfiltered liquid to continue its rise, the float switch again reverses the flow of liquid through the valve, returning to the filtering cycle. Sludge removed from the screen tubes drops to the bottom of the filter compartment where it is removed by chain driven flights.



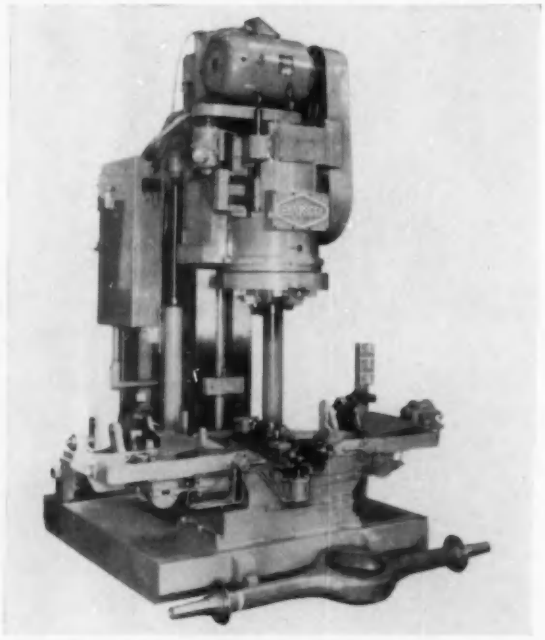
*Delpark Filter-Matic tubular screen type filter features small floor requirements and 5 to 1000 gpm flow capacities*

When precoat is used, an automatic measuring device, with a vibrating mechanism to prevent bridging of the precoat material, is mounted above the filter inlet and automatically feeds a predetermined amount of precoat material at each backwash period. The precoat feeding device is actuated by the air cylinder feed which operates the multiple chamber valve. This automatically adds new precoat at the same time the old precoat is backwashed from the tubes. *Industrial Filtration Co.*

Circle 35 on postcard for more data

# NEW PRODUCTION and PLANT EQUIPMENT

## Cross Feed Unit Faces Rear Axle Housings



*The basic unit pictured is set up for making a cut across the face of a rear axle housing. On loading, a hydraulic clamping fixture grips the two ends of the housing. A gage on the fixture swings out over the housing to locate the center. The fixture handles four different size housings. Tooling is a standard cross feed facing head. Output is 34.2 housings per hour at 100 per cent efficiency. The machine is adaptable to other uses such as boring, drilling and tapping, by changing heads. It can also be automated with loading and unloading devices. (Baker Brothers, Inc.)*

Circle 36 on postcard for more data

## Hydraulic Fluids

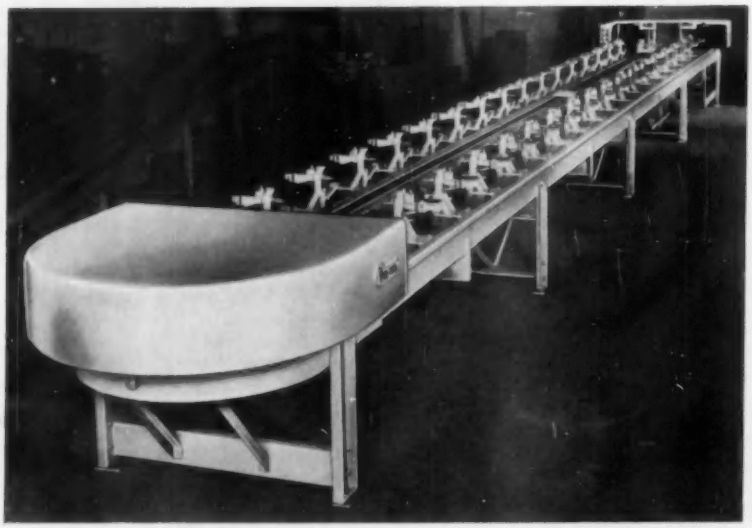
Two fire-resistant hydrolube fluids, Ucon 150-CP and 275-CP, have outstanding corrosion and wear resistance, according to a recent announcement of their availability. It is said that laboratory tests and industrial service over a two-year period have shown that the wear resistance of the CP hydrolubes is markedly improved and is in the same general range as petroleum hydraulic oils. Also that these tests have shown improved vapor phase corrosion protection for ferrous metals over that of previous formulations.

The company further indicates they have no harmful effects on packings or seals and are characterized by excellent shear stability, high viscosity indexes, and low pour points. Ordinary filters are suitable for use with these fluids; and handling reportedly presents no problems because they are formulated from relatively safe and widely used chemicals. *Carbide and Carbon Chemicals Co.*

Circle 37 on postcard for more data

## Indexing Conveyor for Assembly and Machining

Assembly, inspection or light machining operations are said to be ideal applications for Conveymatic "Carrousel" platen conveyors, which are obtainable in any length, in 10-ft multiples, up to 100 ft, with automatic indexing and adjustable dwell for work cycle. Working height is 38 in., adjustable up or down 2 in. Width is 4 feet and can be varied to specifications. The heavy-duty 10-in. by 12-in. carrier platens support up to 100 lb and are drilled and tapped to customer specification. They are on 12-in. centers. Top of conveyor is clear permitting easy installation of drill units, hoppers, nut runners, etc. Power is supplied by a hydraulic indexing unit, which operates at 800 psi and is driven by a 2-hp motor.



*Visi-trol platen conveyor, equipped for automatic indexing, adjustable dwell and automatic clamp-unclamp, is tooled for assembly of transmission valve bodies*

The 40-ft unit shown is tooled for the assembly of transmission valve body assemblies. It has 86 carrier platens, of which 80 are always usable. In this case, fixtures are mounted on alternate platens and index is 24-in. in three seconds, with an adjustable dwell for the work cycle. Fixtures can be removed in ½ hour; they feature automatic clamping and are indexed radially in 90 deg increments manually. Production assembly rate is 400 per hour at 100 per cent efficiency.

Standard continuous-drive models also are available in lengths from 10 to 100 ft in 10-ft multiples. Input speed is variable from 200 to 600 fph. Parts pan support rail is standard on all models. Optional features include automatic lubrication, clamping-unclamping, load-unload and off-line handling and storage equipment. *Visi-trol Engineering Co.*

Circle 38 on postcard for more data

## Large Power Quill

THE latest addition to a line of high-speed power quills is a heavy-duty unit, called the Super 80, which develops a full 1½-hp at the quill and provides a continuously variable speed range from 7000 to 25,000 rpm according to its maker. An electric control with a dial allows easy selection of the desired speed. Five grease-

*Precise Super 80 power quill*

sealed micro-precision ball bearings and a rigid quill, together with a high-speed, 115-v universal motor, all contained in a one-piece steel housing, are said to permit milling, grinding or finishing to tolerances of 0.0001-in. There is also a built-in filtration unit.

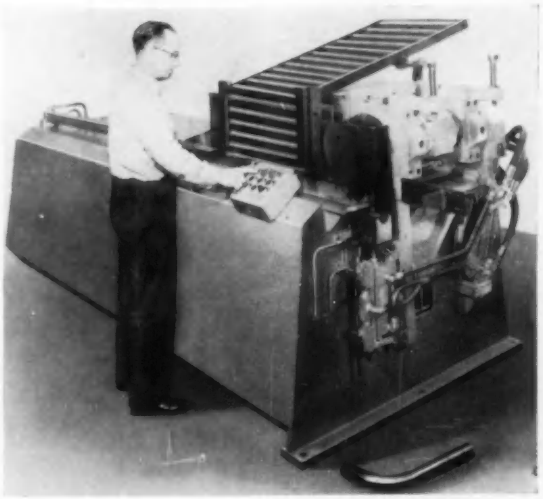
Standard equipment includes a precision collet chuck with a capacity to ½-in. Also available is a solid quill extension accommodating wheels with up to ½-in. ID and 2½-in. OD. Specially-designed mounts are offered to permit easy mounting of the quill on larger standard machine tools, for either single or multiple operations. *Precise Products Corp.*

Circle 39 on postcard for more data

## Anchor Bolt Cement

KNOWN as Evr-Tite, a cement for anchor bolts features fast-setting. It is a light gray powder which mixes readily with water to form a semi-fluid, easily-poured compound. In 10 minutes after application it is said to set with a minimum of shrinkage or pulling away from either bolt or hole. According to the company, anchor bolts cemented with this material can be drawn tight and light equipment put in operation within a half hour. For heavy vibrating machinery, it is said to reach high impact strength in less than one hour. *The Monroe Co., Inc.*

Circle 40 on postcard for more data



*Hill magazine - fed, heavy-duty, high-speed automatic tube bending machine bends the gasoline tank filler neck shown at the rate of 650 parts per hour*

## High-Speed Automatic Bending Machine

SUITED to the bending of parts like exhaust pipes or gasoline tank filler necks, a magazine-fed, heavy-duty, high-speed automatic tube bending machine will bend two-inch diameter steel tubes 90-deg in a four-second cycle, according to a recent announcement. It provides an automatic means of bending tubing up to two-inch diameter to adjustable bend angles up to 180-deg; and on bends with short legs the machine will operate continuously, including automatic part ejection. The unit illustrated makes 30, 45 or 90-deg bends in two-inch diameter steel filler necks at a production rate of 650 parts per hour. This new design, which bends the tubing in a vertical plane, utilizes a single-rotation, hydraulic rotary actuator to provide continuous power throughout the operation.

For automatic operation, tubes to be bent are loaded in a magazine feed where they are gravity-fed to a position in front of a hydraulic cylinder-operated mandrel. When the cycle button is pressed, the mandrel advances a tube to bending position between the dies, a 3¼-in. diam clamping cylinder on the die table clamps the tube in the die and the die table is rotated by the actuator. During this process the mandrel returns to pickup position. A combination of hydraulic, mechanical and electrical stops control the adjustable bend angle. At the end of the bend, the clamping cylinder releases and the operator removes the finish bent part. When the part is removed, the cycle button is then operated, the die table returns to original position and the mandrel advances to place another tube in bending position between the dies.

The machine has a welded steel base. All electrical and hydraulic power units and controls are JIC-mounted in the base. Both manual and automatic cycle controls are included in the pushbutton control panel. The hydraulic system includes 40-gpm, 1000-psi, high-volume variable-flow pump powered by a 30-hp motor which operates the die table; and a 5-gpm, 2000-psi, low-pressure, low - volume, positive - displacement pump powered by a 5-hp motor that is used for clamping. *Walter P. Hill, Inc.*

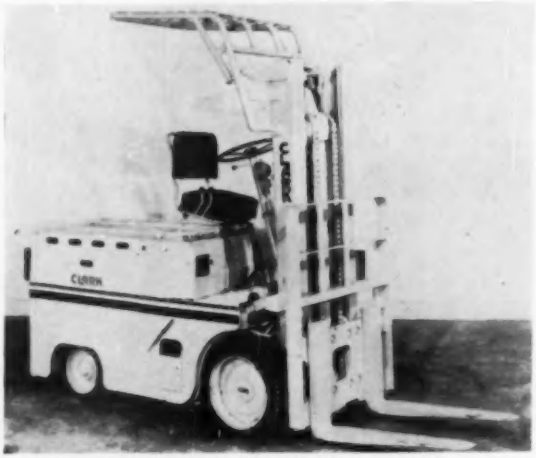
Circle 41 on postcard for more data

## Maintenance Coating

CORROSION-RESISTANT, a vinyl maintenance coating called Ucilon 1400 is said to eliminate the strong odors and the need for meticulous surface preparation associated with prior vinyl-based coatings. It reportedly resists attack by acids, alkalies and water, and may be used on walls, floors, ceilings and exteriors of equipment in corrosive-fume industrial atmospheres.

The company states the coating brushes out like oil paint and that it is self-priming, being applicable over bare metal, wood, masonry and most previously-painted surfaces without special surface preparation. Six colors are available. *Metal & Thermit Corp.*

Circle 42 on postcard for more data



*Clark EUT-8024, the newest model in the company's line of battery-powered fork lift trucks, is of 8000-lb capacity. Features include four speeds forward and reverse, three independent braking systems, and the use of a "tilt-lock" valve in the hydraulic system*

## New 8000-Lb Capacity Battery-Powered Truck

THE latest addition to a line of battery-powered fork lift trucks is the EUT-8024, an 8000-lb capacity model with dual drive wheels. A turning radius of 85 in., aisle for right-angle stacking (including 48-in. long load) of 148½ in., and overall length of 133 in. are dimensional features of the unit. With four speeds forward and four reverse, it will travel loaded at 5½ mph and climb a 10 per cent grade, according to the announcement.

Power comes from a dual field, high-torque motor. A finger-tip directional control lever on the steering column controls first speed in each direction, and mechanically cuts off power and locks in neutral when the operator's seat is empty. Second, third and fourth speeds are attained by a foot accelerator operating a master control switch. The control panel includes magnetically-operated contactors providing automatic acceleration, with pre-set time delay between each point of power. Plugging and timing relays avoid excessive current in drive motor during reversal of truck. A switch operated by the brake pedal cuts off power to drive motor when the hydraulic brakes are applied.

The EUT-8024 has three independent braking systems. In addition to hydraulic brakes, a "deadman" brake mounted on the drive motor armature applies automatically when the operator leaves his seat. The machine also can be braked by reversal of power in first speed.

An automatic "tilt-lock" valve in the hydraulic system prevents "drifting" of the uprights under heavy loads. The hydraulic system is controlled by a Vickers "feather-action" spool type sectional valve with built-in pressure relief. Telescopic, axle-mounted uprights are of heavy section alloy steel channel.

Weight of the truck is 11,580 lb with a lead acid battery and 11,378 lb with an alkaline battery. *Industrial Truck Div., Clark Equipment Co.*

Circle 43 on postcard for more data

## Brazing Alloys

HIGH-NICKEL brazing materials, in a series of four alloys, have been introduced for brazing stainless steel and heat-resistant alloys. Called Hi-Temp alloys, they are said to offer high strength at elevated temperatures and superior resistance to corrosion and oxidation. Stated to be particularly useful for brazing austenitic stainless steel, high-nickel heat-resistant and precipitation-hardening alloys, they will also braze carbon steel and nonferrous metals having melting points above 1850 F. Applications include joining high-temperature resistant parts for jet engines and rocket motors, honeycomb structures, heat exchangers, and corrosion-resistant equipment for chemical processes. All the alloys are available as cast rod, powder and resin-bonded sheet, as well as in forms fabricated and sintered from the powder.

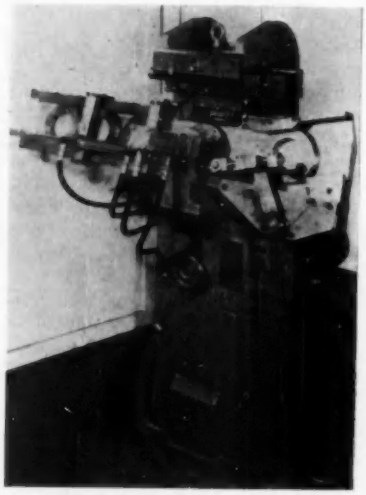
Properly designed joints will have tensile strengths of 75,000 to 95,000 psi depending on the atmosphere used, joint clearance and the composition of the brazing alloy. The mechanical properties, corrosion-resistance and oxidation-resistance of these alloys are said to closely approximate those of stainless steel and heat-resistant alloys.

The four high-nickel alloys have flow points in the range of 1825 and 1925 F. The four compositions vary appreciably in degree of fluidity, ductility, corrosion-resistance, and wetting characteristics with various parent metals, permitting the user to select the alloy best adapted to his requirements. *Handy & Harman.*

Circle 44 on postcard for more data

## Ring Gear Marker

THE Model 175-S marking machine illustrated is equipped for marking the peripheries of ring gear blanks. Parts are rolled into the feed chute at right of machine, from preceding operation, and are guided into position at the marking station. They are stopped at this point for an instant, during which time a hydraulic stud slips through the bore, thus supporting the gear. The arbor raises the gear to marking position at the moment the die slide, carrying the lettering tool, starts forward. After marking, the supporting arbor lowers and recedes. A hydraulic arm engages the gear in the bore, carrying it to the discharge chute at the left.



*Schmidt Model 175-S marking machine*

The entire operation is automatic, requiring no operator. Serial numbering, or fixed lettering, or both can be incorporated in the marking tool. *Geo. T. Schmidt, Inc.*

Circle 45 on postcard for more data

## Self-Feed Screw Driver

DEVELOPED for mass assembly operations, a portable, self-feeding, completely automatic power screw driver called Semspak drives screws automatically at any angle and as fast as the operator can pull the trigger. Each screw is fed into the driving jaws and held tightly in place until started into the workpiece. The operator has full visibility of the driving head, screw and mounting hole.

The screw supply is always visible and is replenished by replacing the screw cartridge. The cartridge holds 60 #8 screws, slightly less with #10 screws. Screw cartridges are loaded from an automatic electric hopper, which can be used to supply several drivers. A number of loaded cartridges can be kept ready, and 1½ cartridges of screws are in reserve in the hopper track. The tool will accommodate screws with a 7/16-in.

*Semspak self-feeding screw driver*

minimum length and a 1½-in. maximum length, having either round, pan, oval, flat, fillister, hexagon, slotted or Phillips heads.

Eighteen inches long, the Semspak weighs 6½-lb. One light-weight air hose provides the power supply. Torque is adjustable quickly after removing the air motor and clutch by a simple hand-twisting motion. No other adjustments are needed. Bits for varying screw sizes and heads can be replaced in seconds without the need for special tools. *Shakeproof Div., Illinois Tool Works.*

Circle 46 on postcard for more data

## Optical Torque Tester

A WIDE-RANGE power-operated optical tester which is said to be capable of accurately testing all types of torque wrenches has been announced. Wrench types include direct reading, reflex signaling, complete releasing, bending beam, rigid frame, solid handle, pivoted handle, ball handle and tee handle. Provision is also made on the metal cabinet of the tester to permit the mounting of special external fixtures for miscellaneous production and laboratory tests, such as the test of a sensitive clutch mechanism. The addition of a power-operated mechanism enables the checking and setting of mechanical time fuses. With a simple fixture the equipment also lends itself to the recalibrating of strain-gage devices. Another adapter is available for recalibrating cable tensiometers.

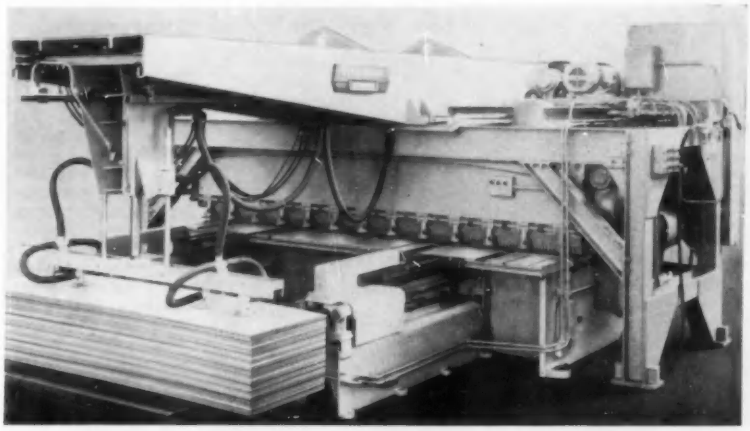
The tester features a torsional shaft measuring element that is submerged in preheated oil which enables constant operating temperatures for the measuring device. There is no mechanical connection between the measuring element and the indicating pointer, as the pointer is projected onto the scale through an optical system. The indicating pointer, as it appears on the television-type screen, travels across a ribbon scale for a distance in excess of 10 ft in total length. The pointer is a shadow image and therefore there is said to be no parallax error when an operator views the screen.

Another feature of the tester is that it is equipped with a power loading device. It is reported that a torque wrench can be tested to full capacity in seconds, or may be checked quickly over each increment marking on the full scale range of the wrench. The loading arm is operated by an air-draulic system, and movement of the arm can be controlled with a metering valve so that it will move as slowly or as rapidly as desired.

The tester is available in three models. The OTT 250-I has two range scales of 0 to 250 lb-in. and 0 to 4000 oz-in. On the OTT 165, range scales are 0 to 165 lb-ft and 0 to 1980 lb-in. The OTT 500 range scales are respectively 0 to 500 lb-ft and 0 to 6000 lb-in. *P. A. Sturtevant Co.*

Circle 48 on postcard for more data

*Sturtevant optical torque tester*



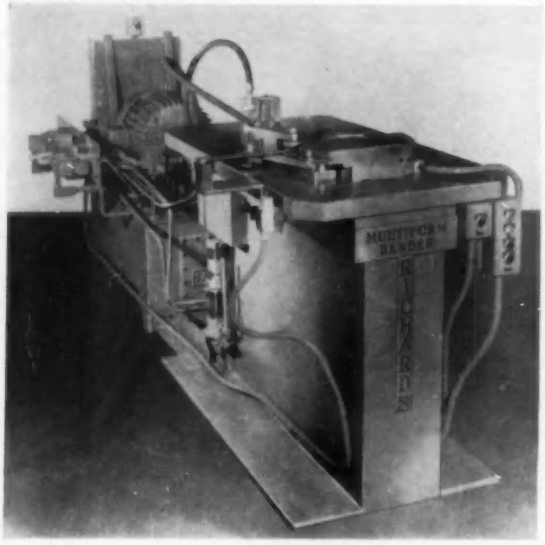
## Automated Sheared-Blank Production Unit

*Called the Auto-Shear, the unit shown employs the company's 1812 series shear in conjunction with automatic handling equipment to form an automated sheared-blank production machine. This equipment picks up the unsheared sheet, deposits it on the shear table, feeds it into the shear against the back gage, and makes the cut. Sheared blanks are conveyed beyond the rear of the machine, where they are picked up and neatly stacked. All of these operations are done automatically. (The Cincinnati Shaper Co.)*

Circle 47 on postcard for more data

# NEW PRODUCTION and PLANT EQUIPMENT

## Bending Machine for Multiplicity of Operations

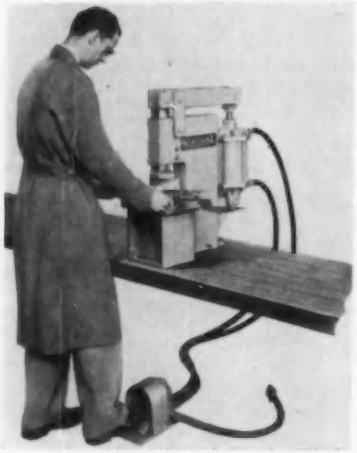



*The Model BB-CS hydraulic Multiform bender illustrated has special tooling for processing tubular seat back supports in various sizes. It can also be equipped for such operations as bar forming, stamping, blanking, staking and piercing, using dies and/or mandrels, including auxiliary bending sweeps. Table size is 30 by 56-in. Standard ram stroke is 4-in.; auxiliary cylinder sweep stroke 18-in.; and shut distance between heads 6-in. and 8-in., adjustable. Bending power is 25 tons; automatic operating cycle 6-sec. (J. A. Richards Co.)*

Circle 49 on postcard for more data

## Notcher and Punch

With 6½-ton capacity and 4¾-in. throat, a new air power notching and punching machine can be equipped with a large selection of punches and dies for simple or intricate holes, corner trimming, or combination trimming and cut-off. A foot valve frees both hands for locating and feeding the material. The ram can be lowered gradually, to locate work at prick-punched points and to facilitate die changing. Throat permits notching and punching well inside edge of sheet.



*Niagara air power notcher and punch*

A special duplex setup with two machines mounted on a single stand for edge or corner notching facilitates the fabrication of drums, pans and similar objects. A single foot valve operates both machines simultaneously. Other optional equipment includes floor stand; feed table with adjustable squaring edge, particularly advantageous when handling large sheets; and a variety of notching and punching attachments. The machine operates on shop pressure of 80 psi. *Niagara Machine & Tool Works.*

Circle 50 on postcard for more data

## Machine Controls

Electro-hydraulic control of machinery is said to be made practical by a transistorized servo amplifier and an electro-hydraulic servo valve which were announced recently. The two components are reported to combine the best features of electronic signal sensing with hydraulic control of variable delivery pumps, hydraulic motors, cylinders and similar equipment. According to company engineers, the XRJ301A amplifier and the XVJ300A servo valve make it feasible to apply hydraulic power to many applications previously limited to electric drives; and also provide precision control of existing hydraulic equipment which could not previously be controlled automatically.

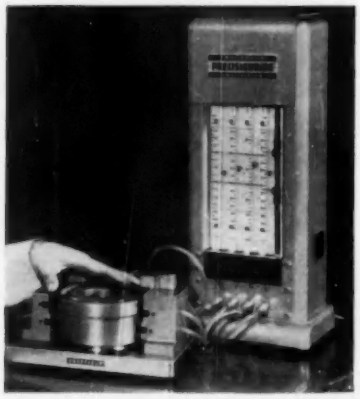
The amplifier is designed to receive signal inputs from any standard 60-cycle a-c signal source. The user can provide manually variable controls, can make the control source a function of position, velocity or other command variable, or can utilize input signals from tracers or computers. The amplifier is designed for parallel summation, ratio comparison, or series summation of input signals. Output is designed to power a balanced single load, or split loads, of as high as five watts.

The amplifier supplies the driving power for the electro-hydraulic, three-way servo valve which, in turn, controls the flow of oil to hydraulic linear or rotary motion drives. The single stage servo valve is driven by a high performance torque motor and is available in ratings up to 10 gpm and 3000 psi.

Linear motion control can be applied to hydraulic presses, reciprocating drives used in planers, grinders, or saw mill carriages, and in a variety of straight line positioning applications. Rotary motion applications include lead screw feeds, spindle drives, and processing machinery which require precise control of shaft rotation. Control combinations possible with the electro-hydraulic servo "team" include stroke control feedback, pressure or flow feedback, and feedback of load position, velocity, force, torque, etc. *Minneapolis-Honeywell Regulator Co.*

Circle 51 on postcard for more data

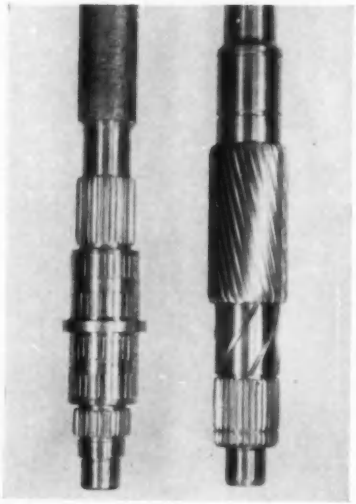
## Multi-Dimension Gage



*This four-column Precisionaire pneumatic gaging assembly checks two OD's, the ID, and the overall length of a transmission ring gear, simultaneously. Plunjet gaging cartridges are used as the size-sensing elements. (The Sheffield Corp.)*

Circle 52 on postcard for more data

## Formed Oil Grooves



*Multiple oil grooves, either straight or helical, may now be formed automatically on shaft bearing surfaces by the Roto-Flo process, according to a recent statement. The machine rolls the grooves into the shaft journal by means of toothed racks, in a single pass. Oil grooves adjacent to splines on a shaft may be formed in the same pass as the splines. (Michigan Tool Co.)*

Circle 53 on postcard for more data

*Yale & Towne magnetic attachment for electric industrial lift trucks improves efficiency of handling metal plate*

## Lift Truck Magnetic Plate-Handling Attachment

THE development of a magnetic attachment for industrial lift trucks, as a means of insuring fast, safe handling of metal plate, has been announced. The attachment, mounted between the forks of an electric truck, operates automatically when a control switch on the cowl of the truck is placed in the "on" position. Turning the switch "off" permits regular fork handling with the lift truck. More efficient handling of metal plate is said to be possible with this new development because the action of the magnet prevents the load from slipping or tipping. The magnet between the forks becomes energized (the switch being on) as soon as the load depresses a bar switch located in the middle of the magnetic plate. This action also lights a small light on the cowl showing the operator that the magnet is in operation.

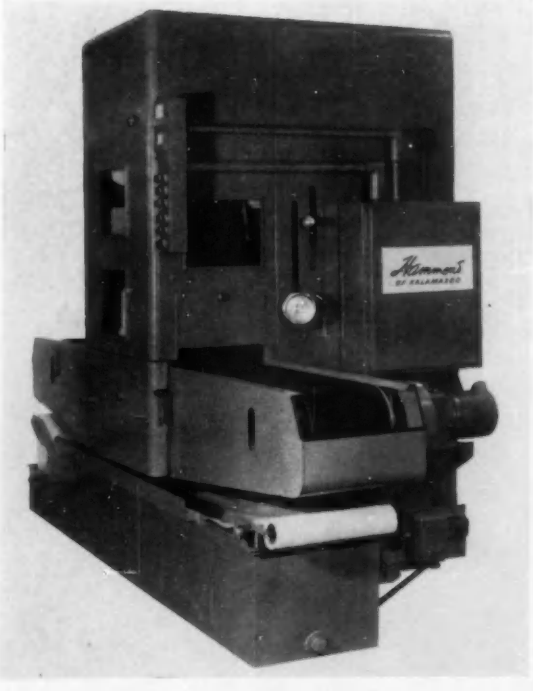
As a safety preeaution, the forks on the truck are pivoted at their base. A tension spring at the top of the forks holds them in a straight upright position when empty, while the weight of a properly-placed load moves the fork backs forward slightly against a pair of stops. If a load is not placed properly on the forks, one of them will not move forward. When this happens, the hoist mechanism of the truck will operate, but the truck cannot be moved in either forward or reverse.

Upon placement of the load, the magnet is de-energized automatically by the action of the fork backs, which are pulled to the rear by their springs as soon as contact with the load is broken.

There is a demag button centered with the on-off switch and the signal light on the truck cowl. This is for emergency use to over-ride the action of the magnetic attachment in case of unusual circumstances where an operator might encounter an inoperable situation with an improperly-placed, partially-raised load. *The Yale & Towne Manufacturing Co.*

Circle 55 on postcard for more data

## Twelve-Inch, Conveyor-Type Flat Finisher



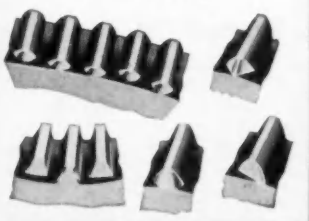

*The Model FF-12 flat finisher illustrated was designed for wet abrasive belt grinding, polishing and deburring of flat work such as sheets, strip, bars, stampings, plates, etc., up to 12-in. wide and 6-in. high. Continuous feeding of work is through use of a variable-speed air-tensioned endless conveyor. The head of the machine is of two-roll design, employing an abrasive belt 12-in. wide by 126-in. long. Other features and optional equipment include power elevation for head adjustment to work, 6 to 10-in. diam contact rolls, adjustable work hold-down rolls, magnetic conveyor platen and automatic coolant filter. (Hammond Machinery Builders, Inc.)*

Circle 54 on postcard for more data

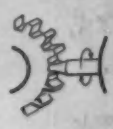
# CHAMFER or DEBURR GEARS and SPLINES the *Low Cost* SHEFFIELD WAY

The ends of gear teeth or splines of all kinds are deburred, chamfered, recessed or precision formed to your requirements at high production rates by these Sheffield machines.

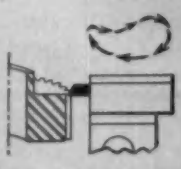
Tooth Forms



**340 Series Machines Chamfer or Deburr:**
120 Gear Teeth per Minute **using a Hollow Mill**
60 Gear Teeth per Minute **using a Pencil Cutter**

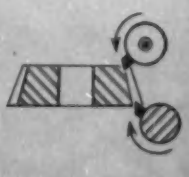


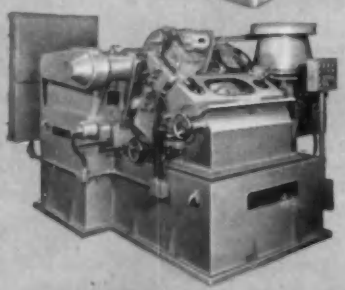
**380 Series Machines Deburr:**
250 Gear or Spline Teeth per Minute **using a Reciprocating Chipper Tool**



**370 Series Machines Deburr:**
250 Spline Teeth per Minute **using a Flytool**

**350 Series Machines Deburr:**
300 Spiral Bevel or Hypoid Teeth per Minute, **both sides simultaneously using Two Flytools**





**Gear Deburr Grinder removes burrs from**
1200 Spur or Helical Gears per Hour

7233

For descriptive literature on this equipment write to Div. 4, The SHEFFIELD CORPORATION, Dayton 1, Ohio, U.S.A.

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# Free INFORMATION SERVICE

**Use either of these postcards for Free Literature listed below, or for more information on New Production Equipment and New Products described in this issue.**

USE THIS POSTCARD

## FREE LITERATURE

### Cluster Fittings 1

Entitled "Aircraft Piping and Engineering Application Manual," 44-page booklet AM-13 covers cluster fittings for aircraft applications. *The Weatherhead Co.*

### Weighing Systems 2

Bulletin 561, 12 pages, features arrangements of a line of tank and bin weighing systems. *The A. H. Emery Co.*

### Aircraft Switches 3

Enclosed switches for airborne equipment is the subject of 24-page Catalog 77, which gives data on 12 different classifications and on over 70 different switches for aircraft application. *Micro Switch Div., Minneapolis-Honeywell Regulator Co.*

### Wire Terminals 4

Continuous-strip terminals for automatic welding to wire ends are listed in a four-page publication. Also briefly described is the machine used for the process. *Wade Electric Products Co.*

### Metal Finishing 5

Applications, in case history form, of polishing and grinding wheels formed from die cut, cloth-backed, coated abrasive segments locked in a hub, are presented in a 12-page booklet. *Minnesota Mining and Manufacturing Co.*

### Ultrasonic Inspection 6

The ultrasonic Immerscope test unit, model PT 1001, for non-destructive immersion testing of materials for internal flaws, is described in a six-page bulletin. *Curtiss-Wright Corp.*

### Plating Solutions 7

"Simple Methods for Analyzing Plating Solutions" is the title of a 36-page bulletin, which includes 28 analytical methods for testing nickel, copper, cadmium and other metal-finishing solutions. *Hanson-Van Winkle-Munning Co.*

### Vacuum Pumps 8

Vacuum processing data is contained in Catalog 752, 28 pages, which describes a line of rotary mechanical high-vacuum pumps. *F. J. Stokes Corp.*

### Annunciator Systems 9

Catalog 100B, 32 pages, presents a complete line of integrated annunciator systems for industrial process applications. *Panalarm Div., Panellit, Inc.*

### Palnut Tools 10

Data on high-speed methods of assembling Palnut lock nuts and fasteners with specially-designed wrenches and tools is given in eight-page catalog 516WR. *The Palnut Co.*

*(Please turn page)*

**VOID After Feb. 15, 1957** **12/15/56**

**Circle code numbers below for Free Literature, New Plant Equipment, or New Product Information**

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## Industrial Greases 11

Two water-resistant extreme-pressure greases, especially recommended for shock-loaded bearings, are described in Technical Bulletin 49. *Sun Oil Co.*

## Heat Treat Furnaces 12

Bulletin SC-175, eight pages, shows a line of 27 standard rated heat treat furnaces for all types of industrial heating applications, from small laboratory furnaces to large continuous brazing furnaces. *Surface Combustion Corp.*

## Molded Plastics 13

An eight-page manual on molded plastics includes sketches to aid the designer of molded plastic parts and lists the properties of 13 different materials, with suggested typical applications for each material. *The Richardson Co.*

## Hydraulic Systems 14

Hydraulic systems for turbojet and turboprop aircraft engines are discussed in eight-page illustrated Bulletin A5211, which describes basic control requirements and various control components. *Vickers, Inc.*

## Air Compressors 15

Catalog 820, 16 pages, describes a complete line of automotive, industrial and portable air compressors, and includes specifications and chart for selecting the most efficient unit for a particular use. *Binks Manufacturing Co.*

**USE THIS POSTCARD**

## Strapping 16

Strapping applications, ranging from such items as a semi-automatic machine for reinforcement and unitizing of corrugated containers, to strapping used for flat carloads of lumber and packaging of sheet steel, are shown in the "Blue Book of Packaging Number Three," 36 pages. *Gerrard Steel Strapping Div., United States Steel Corp.*

## Plasticizers 17

"Plasticizers" is the title of a 48-page bulletin which lists the properties of 15 plasticizers. Performance data with polyvinyl chloride are presented, along with recommendations for use with cellulose resins, polystyrene and synthetic rubber. *Kessler Chemical Co., Inc.*

## Concentric Grinder 18

A four-inch concentric grinder, which uses a shoe-type centerless grinding method for ring-shaped parts with either straight or profiled shapes, is described in Catalog CX-56, four pages, available from *Landis Tool Co.*

## Socket Screws 19

Detail specifications and application data on self-locking Unbrako socket screws incorporating the Nylok insert, are presented in 16-page booklet, Form 2193. *Standard Pressed Steel Co.*

## Compound Melters 20

Bulletin 043W, 6 pages, features a line of compound melting tanks, kettles, pots, and accessories, and describes the principle of operation of units for heating, melting, conveying or dispensing melted compounds, soft metals, thermoplastics, adhesives, etc. *Sta-Warm Electric Co.*

## Welding Rod 21

An informative four-page flyer, Bulletin DH-1218-J, details the physical properties as welded, and lists typical uses of, gas welding rods, bare electrodes, automatic welding wire and metal spray wire. *American Chain & Cable Co., Inc.*

## Dye Penetrants 22

"How to Perform Dye Penetrant Inspections," a four-page folder, discusses various aspects of penetrant flaw location. *Turco Products, Inc.*

## Instrumentation 23

Information on a line of instruments for analysis, control, and data processing is given in Bulletin 1305, 32 pages, illustrated. *Consolidated Electrodynamics Corp.*



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- LOW COST
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- SELF-LOCKING
- VIBRATION-PROOF
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*Pulls up tight without backup on flat or contoured surfaces*

**T.C.F. for 1/8" stud shown actual size. Also available for 3/16" stud.**

**T.C.F. for 1/8" stud with plastic sealer.**

Specially designed to hold die-cast or cold-formed name plates, emblems and trim against sheet metal surfaces, DOT's new T. C. F. cuts clean, deep threads on unthreaded studs, even those that are chrome plated. Immediately available in 1/8" and 3/16" studs.

When used with its pre-assembled plastic sealer, the new T. C. F. makes a watertight seal. The sealer *precedes* the fastener onto the stud so that it is not damaged by the thread-cutting process.

Available *in quantity* with or without sealer from Monadnock Mills subsidiary and Carr Fastener Division.

*United-Carr's design staff is ready to apply the same engineering creativity that produced the T. C. F. and thousands of other special-purpose fastening devices to the solution of your special fastening problems. Field representatives are located in most principal cities.*

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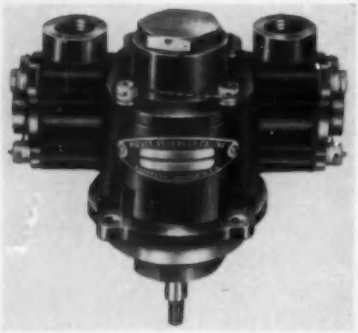
UNITED-CARR FASTENER CORPORATION

# NEW PRODUCTS AUTOMOTIVE-AVIATION

*FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89*

## Fuel Control Units

The release of two fuel control units for use on turbine type auxiliary power units and guided missiles was recently announced. Basically they are mechanical type governors



with single or dual valve systems incorporated into the design. Single valve units control the flow of one fuel; while the dual valve system controls and proportions the flow of two fuels ranging from JP-4 through red foaming nitric acid.

The unit, weighing less than three pounds, requires an input of 0.8-hp. It is stated that at an operating speed of 10,000 rpm, fuel flows of 10,000-lb per hour can be controlled with complete stability attained in less than 0.2 sec after transit from full open to full closed valve positions. Design flexibility is said to permit adaptation to control fuel flows of 500 to 15,000-lb per hour at higher or lower operating speeds. *The Pierce Governor Co., Inc.*

Circle 60 on postcard for more data

## Aluminum Oxide Coating

For use with flame-coating, aluminum oxide is now being offered as a valuable coating on parts where resistance to erosion and corrosion at high temperatures is necessary in addition to prolonged wear life.

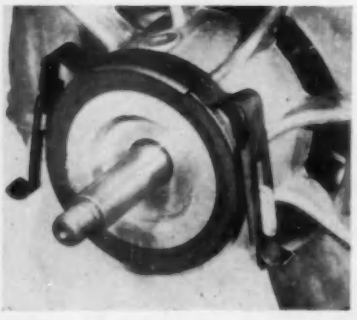
The 99 per cent gamma aluminum oxide coating has a hardness of 1000 to 1200 VPN (300 gram load), and less than one per cent porosity It can be applied in thicknesses from 0.001 to 0.040-in. onto all common metals. Deposition on ceramics and glass is also possible. Common acid and salt solutions, oxidizing and reducing atmospheres, and many low temperature molten metals do not affect the coating, it is said. The coating reportedly does not begin to deteriorate below 1200-deg F, and in some cases, not below 1800-deg F. The actual temperature at which coating breakup occurs depends upon the base metal. Aluminum oxide, like flame-plated tungsten carbide, can be left at the as-coated roughness (125 to 150 microinches rms) or finished to one microinch rms.

Some suggested uses for aluminum oxide coatings are: seals operating under heat and in corrosive media, thrust bearings, pump plungers, aircraft engine parts, guided missile components, heat-resistant surfaces for electronic components, and all areas where resistance to temperature and wear is required. *Linde Air Products Co.*

Circle 61 on postcard for more data

## Motor Mounting Bracket

A fast-mounting motor bracket which eliminates parts and features four-point holding has been announced. The bracket during installa-

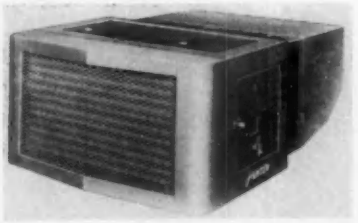


tion is snapped into place by hand with a screwdriver or similar hand tool. Once in position it is self-retaining and requires no further adjustment. The manufacturer claims this design has added torque resistance and holding power, in addition to permitting reductions in costs. *Prestole Corp.*

Circle 62 on postcard for more data

## Cargo Cooler

Introduction of a compact, lightweight, hydraulic-drive cargo cooler marks the entry of a company into the field of mechanical refrigeration for the transport industry. The unit, Model HE-15-A, weighs 360-lb, and



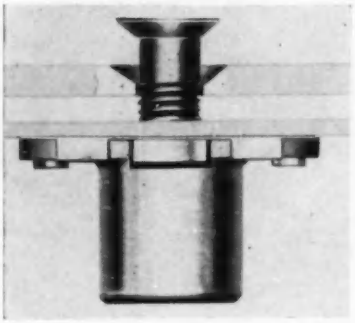
has a cooling capacity of 14,200 Btu per hour at 20 F evaporator and 90 F ambient temperatures. It is designed to meet refrigeration requirements in the medium temperature ranges of between 35 and 50 F, in four-wheel truck bodies up to about 14-ft in length, for either long or short haul operation. Subsequent models will, it is said, be available for higher capacity requirements.

The cooler is mounted in the front wall of the body above the cab, with approximately two-thirds of the unit outside the cargo area, thus conserving payload space. Power from the engine is transmitted to the cooler through a hydraulic pump which drives the system at constant speed. A thermostat starts and stops the unit to maintain the preset temperature. When the truck is parked, an optional auxiliary electric motor which plugs in on available current, either 110 or 220 a-c, may be used to protect the cargo. *Hunter Manufacturing Co.*

Circle 63 on postcard for more data

## Stress Panel Fastener

Manufacture of a fastener for aircraft access doors, developed to meet needs for an easily-operable mechanism to safely carry stress panel loads, has been announced. It is said to offer a solution to the fastening and unfastening of access doors, often as large as three by five feet, over curved



surfaces. The device comprises two assemblies, stud and retainer, both self-retained, made up of six parts—stud, nut, clip, retainer, washer and spring.

Shear strength equal to NAS 547 specification and/or NAS 334-335 close tolerance bolt is designed into the fastener, according to the company. When seated it is said to provide a positive lock which can be checked by mechanical inspection. When released, the stud automatically ejects from the retainer, permitting panel removal without forcing.

Company engineers state curved panels offer no problem as the small radius of entry of the stud into the retainer allows installation on surfaces of less than one-inch radius. A double-lead thread adds to service life. *Pastushin Industries, Inc.*

Circle 64 on postcard for more data

## Two New Headlamps

Introduction of two new 12-v Vision-Aid headlamps, designed for cars equipped with four-headlight systems, has been announced. The lamps are designated 4001 and 4002, with the last digit corresponding to the number of filaments in each lamp. For easy identification, these digits are molded at the top of the face of the respective lenses. Both lamps are 5¾ in. diam, as compared to 7 in. for present lamps in conventional two-headlight systems.

The 4001 has a single filament situated at the focal point of the reflector, to deliver the high or driving beam. Delivering 37½ w, the lamp has E-Z Aim platforms to enable adjustment with mechanical aimers. Locating bosses on the back of the reflector permit installation only in the correct lamp housing.

The 4002 has two filaments, with the low beam filament positioned at the focal point to deliver an improved passing illumination pattern. While this lamp is essentially a "low beam lamp," it does have a high beam filament, placed below the focal point, to deliver light supplementary to the high beam of the 4001 single filament lamp. The lamp delivers 50 w from the low beam filament and 37½ w from the high. It, too, has E-Z Aim platforms and the locating bosses for correct installation.

The new lamps may be mounted either in vertical or horizontal arrangements. Vertically, the 4002 is used in the top position; horizontally, the 4002 lamps are in the outside position. *Tung-Sol Electric, Inc.*

Circle 65 on postcard for more data

## Electric Fuel Pump

The development of an in-tank electric fuel pump for use with internal combustion engines was announced recently. It is said the new pump will be used initially in trucks, but that its application is expected to progress to passenger cars and other engine-driven installations. The first units are scheduled to come off the assembly lines in January.

The pump operates submerged in the fuel tank. Its electric motor is sealed from contact with the fuel. The motor shaft is equipped with a circular magnet which operates through a stainless steel diaphragm or wall, with a similar magnet on the drive shaft of the pumping unit; so that there is no mechanical connection between the motor and pumping unit.

Pressure delivery of the fuel from the tank to the carburetor is said to eliminate the possibility of vapor lock. It is also stated that should vapor form bubbles in the fuel tank itself, the pump is so designed that it will dispel the vapor while delivering solid fuel to the engine. *The Tokheim Corp.*

Circle 66 on postcard for more data

## Thermocouple Connectors

Designed to simplify and speed up the connection of thermocouples to industrial instruments, a line of plug-in components, consisting of a series of plugs, jacks, multiple jack panels and such related hardware as cable clamps and tube connectors, can be used for either single or multiple thermocouple connections. The contact inserts are made of compensating materials suitable for use with thermocouple types J. E. T. S. and R. One contact is slightly larger than the other to prevent improperly polarized connections.

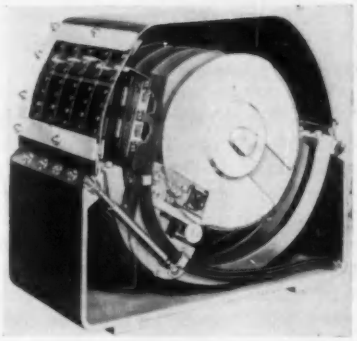
The new units will be marketed under the name Quick-Konnect thermocouple components. *Minneapolis-Honeywell Regulator Co.*

Circle 67 on postcard for more data

## Cam Limit Switch

Developed to facilitate synchronization of multiple operations, a rotating cam limit switch with 15-amp contacts features a micrometer screw adjustment of each switch mechanism in relation to its cam. The adjustment can be made with a screwdriver from the outside, while the switch is in motion.

The "AL" cam limit switch is made in three standard sizes taking up to 5, 9 or 12 cams. The split butterfly



cams can be set with a spread between circuit make and break of from 15 to 345 deg. and the external in-motion adjustment is ± 15 deg.

Contact assemblies may have two sets of contacts, one normally-closed and the other convertible, either normally-open or normally-closed. Contacts can be removed and replaced without disassembling the switch, and the cams are individually adjustable and removable without disturbing the other cams.

The switch is designed to operate at speeds up to 100 rpm, and rotation may be either clockwise or counter-clockwise. *Clark Controller Co.*

Circle 68 on postcard for more data

(*Turn to page* 149, *please*)

# Wide-Range, Two-Speed Double Reduction Axles

ONE of the most effective types of equipment for obtaining performance and operating economy in heavy duty vehicles is the wide range, two-speed, double reduction axle offered by the Timken-Detroit Axle Div., Rockwell Spring and Axle Co.

T-D's wide range axle is available in two ratios; either a range of 2 to 1 or 2½ to 1. When coupled with a standard manual shift transmission or an automatic transmission, it is claimed that the range of ratios will be adequate to meet the most exacting requirements of over-the-road hauling.

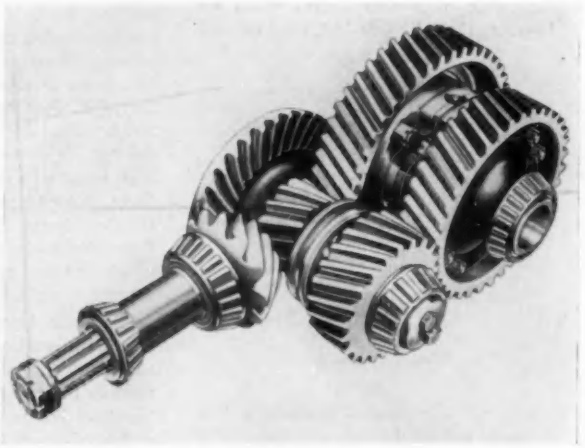
Moreover, such performance is achieved without split shifting or two-stick shifting, and with a simple shift pattern. According to T-D this new concept permits the truck or tractor to be operated continually in the upper ranges of the transmission where engine efficiency and fuel economy are highest. In slow-moving traffic the axle is held in low; on the highway, it is shifted into high for top road speed operation.

Power shifting is effected by means of the "Spring-Flex" shift mechanism which is torque controlled and activated by means of a pre-select switch. The standard attachment can be actuated by air, vacuum, or electric means.

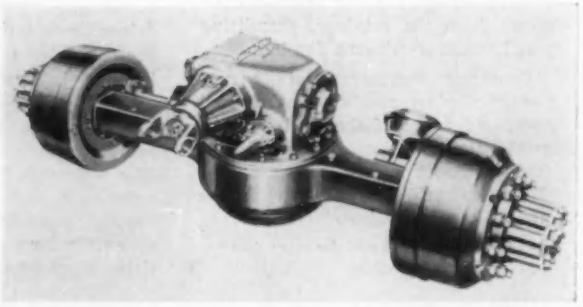
Wide range rear axles are made in two distinct types. The heavy duty Q and R series have top mounted carriers for short wheelbase chassis where minimum propeller shaft angularity is essential. The conventional front mounted carrier axles are supplied in the F, H, and L series.

The heart of the unit is the typical gear set, illustrated here. The wide range of gears ratios was achieved in compact form by moving the pair of high-speed ratio gears to the side away from the drive pinion, permitting the smaller diameter, low-speed pinion to be cradled without interfering with the drive pinion.

Improved design of the shift collar and cross shaft is said to be responsible for trouble-free operation and improved durability. The shift collar has three sets of internal teeth, the outerteeth being used for driving, the center teeth for locking. This arrangement safeguards shift procedure by reducing the risk of slipping out of gear, also reducing gear wear.



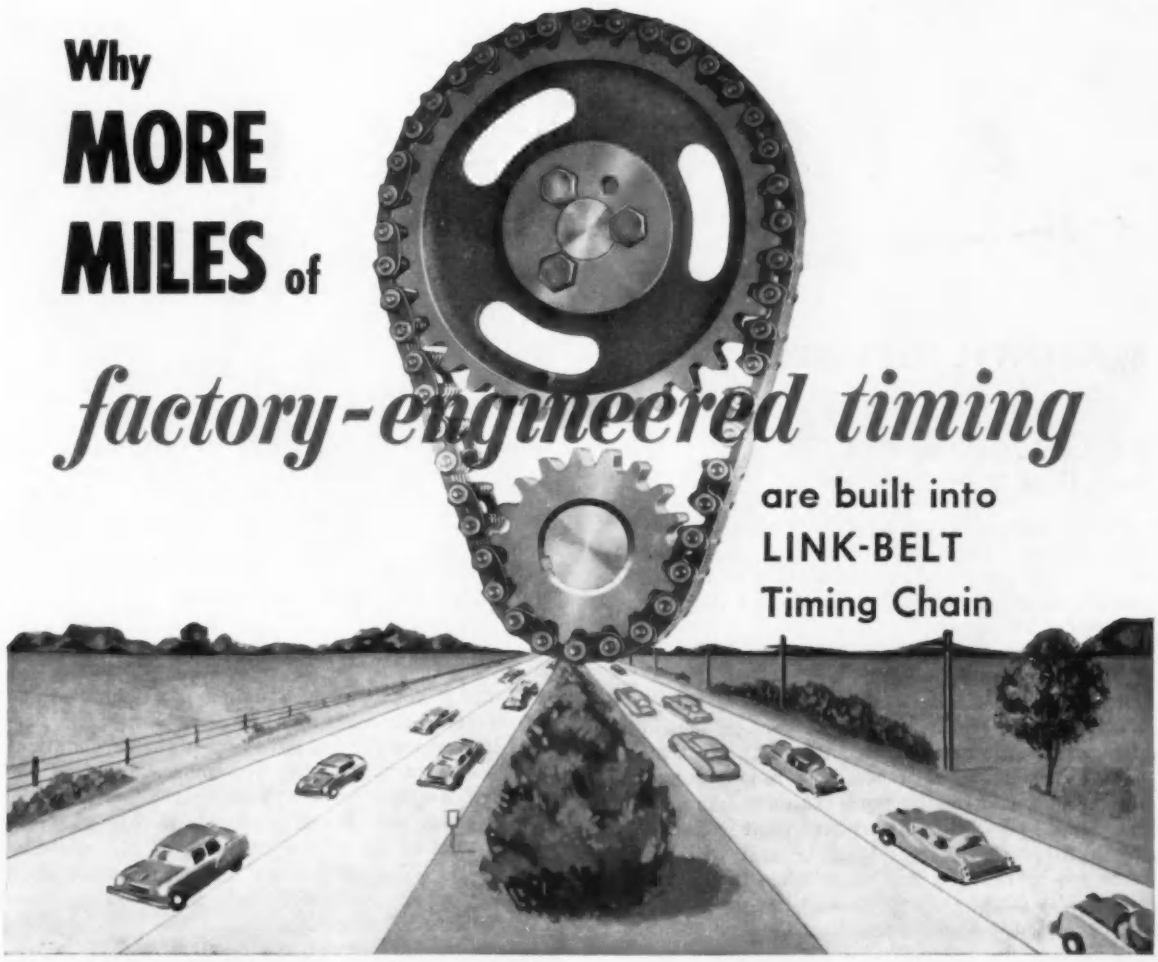
*This gear set is typical of the arrangement in the T-D wide range axle*



*Top mounted carrier design is found in the heavy duty Q and R series axles*

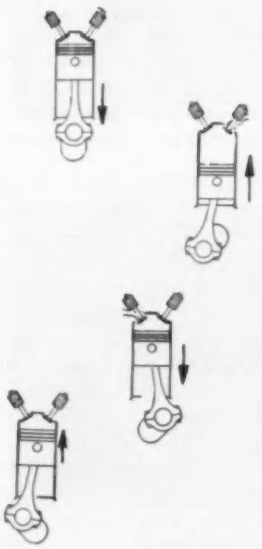
*Front mounted carrier is typical of the F, H, and L series axles*

# Why MORE MILES of *factory-engineered timing*



are built into LINK-BELT Timing Chain

## *Wear compensation joint maintains peak performance longer*



HERE'S why factory-fine valve timing lasts longer with Link-Belt Timing Chain. Adding to the benefits of segmental bushings — which automatically provide snug joints and reduce "slap" on the non-load side — Link-Belt's built-in check in joints allows forward articulation for sprocket engagement but reduces back-bend and whip to a minimum.

In 45 years of timing chain application experience, Link-Belt has developed many "firsts" — including the space-saving $1\frac{1}{16}$-in. width used by major auto makers since 1949. For full details including data you need for layout work—write for Book 2065. 14,231

**LINK-BELT**

THE SYMBOL OF QUALITY · LINK-BELT ·

**TIMING CHAIN AND SPROCKETS**

LINK-BELT COMPANY: 220 South Belmont Ave., Indianapolis 6, Ind.

# AIR BRIEFS

By RALPH H. McCLARREN

## Electronic Testing Unit Cuts Time 20 to 1

Modern aircraft carry a large amount of electronic gear, not only required to keep the aircraft flying and evading inclement weather, but also in case of combat aircraft intercepting the enemy and directing its fire control system.

Beech Aircraft Corp. of Wichita, Kan., has developed an electronic circuit tester which can examine 780 complete combinations of wiring circuits. The new unit will test for intercircuit leakage, continuity of circuits, grounding of circuits and circuit reversals. For example, on a new long range intercepter aircraft it would require more than 570 manual tests to check all possibilities for intercircuit leakage. The Beech Aircraft electronic testing unit will do the same job by rotating the 78 switches in the control panel. Use of the tester cuts a 20 hour manual testing operation to a one hour job.

## Jet and Turboprop Planes

Latest figures available from *Planes*, publication of the Aircraft Industries Association showed that five major aircraft producers now hold firm orders for options from United States and Foreign airlines for a total of 600 jet and turboprop transport planes.

Four-jet transports account for 341 of these aircraft at a total valuation of $1,741,000,000. The remaining 259 aircraft on order are turboprop airliners valued at $323,500,000. Of the total aircraft, 100 of them have been purchased or optioned by foreign airlines.

## Air Conditioning For Jet Transports

Cabin air for the new high flying jet transports will have to be heated or cooled on the ground and cooled in the air. In flying at high altitude atmospheric air ducted into a newly developed engine-driven cabin air compressor must be cooled to reduce the high temperatures caused by compression of the air to make the cabin temperatures and pressures available for best passenger comfort.

Airesearch Manufacturing Division of the Garrett Corp. will furnish the air conditioning equipment for the Lockheed Electra airliner, a turboprop four engine design. The air conditioning unit will have a two stage centrifugal compressor especially designed to meet the needs of the new airliner. This will be integrated with some 35 different components and two electric heaters for each aircraft.

## Major Lester D. Gardner

Lester D. Gardner, 80, founder of the Institute of Aeronautical Sciences and who has spent half a lifetime in working for the advancement of aeronautical sciences and aviation, died November 23rd, at Presbyterian Hospital in New York City.

Major Gardner served in the Army Air Force in World War I. He was a graduate of MIT in 1898 with a Bachelor of Science degree. He published *Aviation* magazine in 1915 and after serving on numerous aviation committees, with the help of other aviation leaders, organized the Institute of Aeronautical Sciences in 1932.

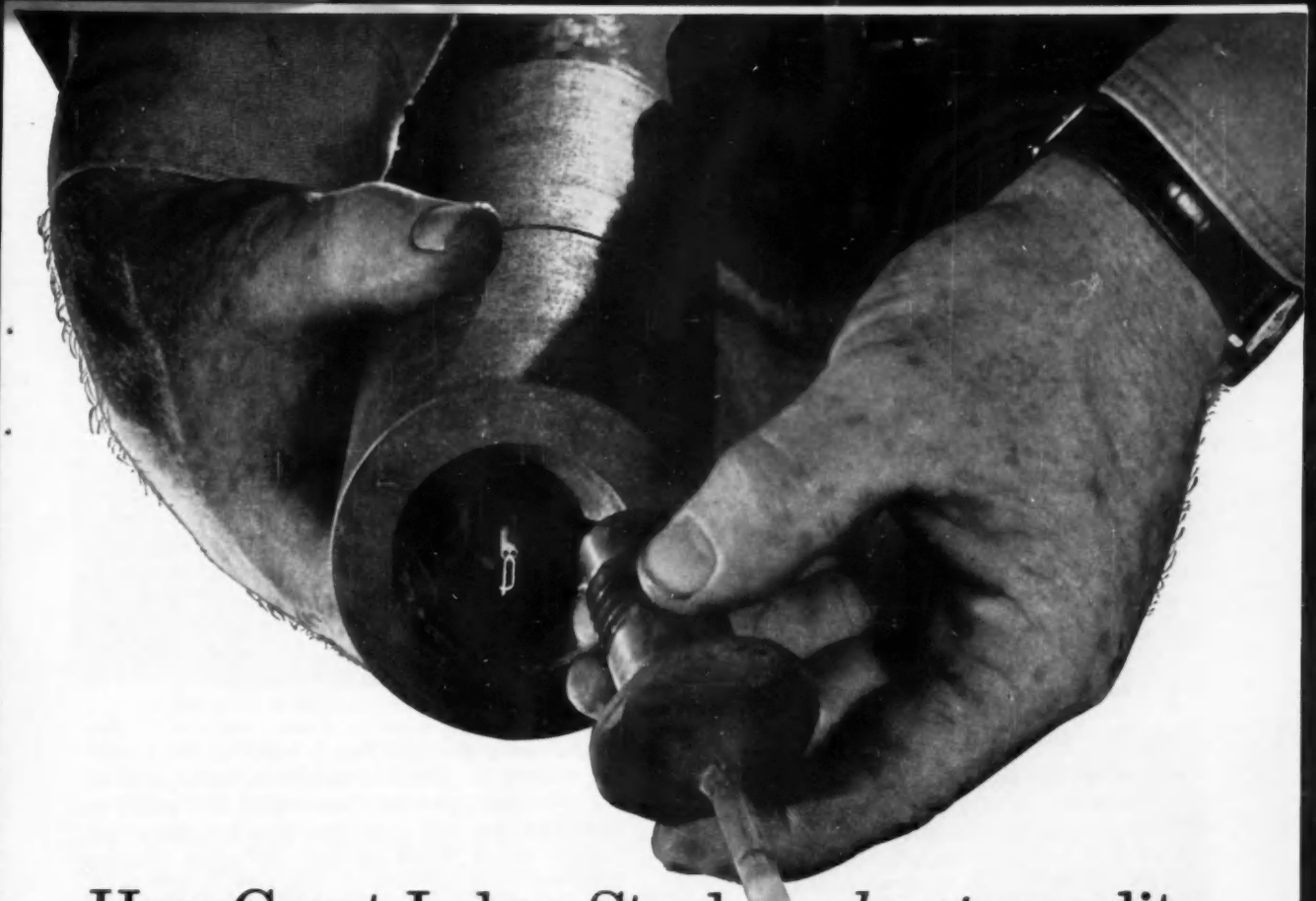
## Machine Tool Numerical Control

The operation of machine tools utilizing so-called electronic brains has recently been evaluated by the Airframe Manufacturing Equipment Committee of the Aircraft Industries Association. Referred to as "numerical control" the technique involved employs the feeding of operating instructions to the machine tool by electronic computer means.

In one instance it was found by the Committee that 100 hours time could be saved in the production of a single part for an airplane. Data to operate the machine tool was coded by an electronic computer and put on a magnetic tape in one and a half hours. Ordinarily it would have required 98 hours to make a template to operate the machine tool by the more conventional tracer method. Then the actual machining was done in one hour compared to four and office paper work was cut from three hours to one by using the numerical control system.

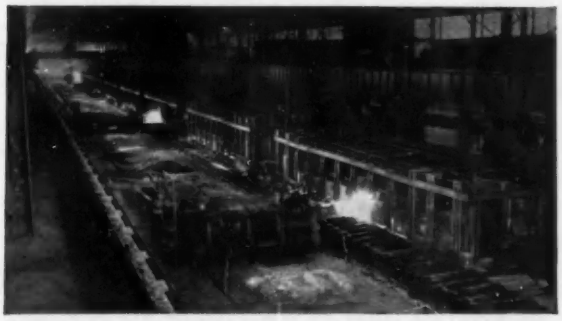
Among advantages cited were improved machine accuracy, lower production costs, reduced time in converting from engineering drawing to finished part

(*Turn to page* 104, *please*)



# How Great Lakes Steel *charts* quality

Left: Thermocouple is inserted into an open-hearth furnace to check temperature of heat. Right: Multiple indicator records open-hearth temperature.



This view shows 12 of Great Lakes 17 open-hearth furnaces. Bright spots are furnaces being charged with pig iron and scrap. The open-hearth process takes from 10 to 12 hours.

This is the business end of a thermocouple, the rugged yet delicately accurate device that measures temperature in an open-hearth furnace. The two fine wires you see above, inside the casing, absorb heat and transmit it as an electrical current to be charted by recording potentiometers.

No chance for guesswork here—through eleven long hours the rising temperature of what will be 500 tons of Great Lakes open-hearth steel is meticulously controlled. Then, at exactly the right time and the right temperature, the glowing molten metal gushes into ladles for pouring into ingots.

The slender, spidery lines on the chart assure another heat of high and uniform quality steel. Quality that is checked and rechecked at every step to assure that customer specifications are met precisely.

Why don't we get together and talk over your steel needs? Some time soon?

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# The BUSINESS PULSE

***Record-Breaking Steel Production and Recent Advances in Output of Automobiles, as Well as Continued Business Investment, Are Principal Factors in Current Business Situation. Employment Total of 66 Million Sets New High for the Season.***

This Survey Is Prepared exclusively for AUTOMOTIVE INDUSTRIES by the Guaranty Trust Company of New York

As 1956 moves towards its close, the general business pattern continues to be one of substantially full utilization of available resources and manpower, accompanied by some upward price pressures. It is a foregone conclusion that gross national product will show a new all-time record for the fourth quarter of the year.

This vigorous pattern is generally expected to continue well into the early part of 1957 at least, in view of the momentum that has been attained. Record-breaking steel production and the sharp advance which has occurred recently in automobile production are the most conspicuous features of this situation, but the boom has other important underpinnings as well. Not the least of these, of course, is the continuing strength of general business investment, which generates a demand for a range of products besides steel. Output of most types of consumer durable goods, furthermore, has been maintained at high levels, and production of nondurable goods has recently recovered from a moderate decline earlier this year. In addition, new construction outlays, though slightly below their midyear peak, are still running at an annual rate of approximately $44 billion, despite the downtrend in home building.

## Employment at New Peak

These strong trends are reflected in labor-market statistics. Total civilian employment during the autumn months ran above 66 million, the highest ever reported for the season. Unemployment fell to the lowest levels since the latter part of 1953, constituting less than three per cent of the civilian labor force. Such a low percentage is widely regarded as approaching the practical peacetime minimum. This indicates that the economy is scraping the "full-employment" ceiling.

There has been little evidence that the broad trend of business in this country is being seriously affected by the convulsive developments abroad. There are, for example, few signs of "scare" buying by either businessmen or consumers, such as followed the flare-up in Korea in 1950.

This is fortunate, for in today's situation of "full employment," the economy appears more vulnerable to inflationary pressures than it was when the Korean war started. At that time the United States had still not fully recovered from the recession of 1949. Thus there was some slack in the economy, with more than five per cent of the civilian labor force, for example, estimated to be unemployed. Yet even in that situation the outbreak of hostilities was followed by a very sharp rise in prices. Today, by contrast, if a war were to break out which involved or threatened to involve this country in any important way, there would be no comparable cushion of manpower and underutilized productive facilities to soften its impact. Hence, the brunt of war demands would presumably be felt more quickly and more heavily, and the threat of serious inflation would be even stronger. Temporarily at least, the possibility of war seems to have receded and lost its sense of immediacy, but a heightened realization remains that peace is more precarious than is sometimes thought.

## Will Consumer Demand Continue?

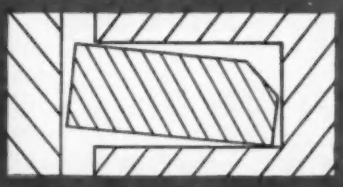
The fact that the economy is in a state of vigorous boom and is expected to continue so for a matter of months at least does not mean that the situation is completely trouble-free. It has to be remembered that the outstanding features of the present boom are in the production phase of economic activity, that is, in high steel output, rising automobile production, and so on. Vigorous production trends, however, are not necessarily self-perpetuating. Rather, they have to be matched by strong and properly balanced demand, if economic expansion is to be maintained. Whether this is in fact occurring is the principal question mark hovering over the economic situation today.

Inventory statistics provide some measure of the adequacy of demand, since they indicate to what extent goods are piling up in warehouses and retail out-

(*Turn to page* 118, *please*)

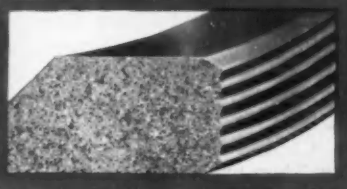
# It takes more than chromium to make a fine Sealed Power chrome-faced compression ring

**THE DESIGN MUST BE RIGHT**



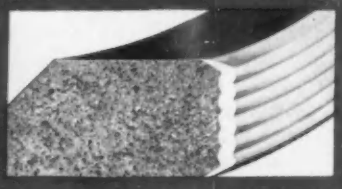
There are many different designs for Sealed Power compression rings. Each was worked out in close collaboration with the designers of the engine in which each ring is to work. Only after weeks of laboratory and actual road testing is any design released for production.

It has been truly said that no chrome-faced ring can be any better than the casting which is its foundation. Sealed Power uses a special chrome-alloy ring iron, perfected by Sealed Power metallurgists for ideal bonding quality as well as all other properties required of a good ring iron.



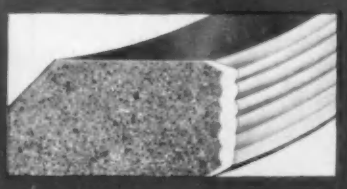
**THE IRON MUST BE RIGHT**

**THE PLATING MUST BE RIGHT**



Electro-plating of the heavy solid chrome face on Sealed Power compression rings is done by a process devised by Sealed Power. Not only is the plating thicker than most, but it is so firmly bonded that there is not the slightest chance of chrome particles flaking off to damage the cylinder wall.

Every Sealed Power chrome-faced compression ring is lapped to a light-tight finish to insure quick seating and immediate oil control—with microscopic oil-retaining grooves machined into the face of the casting to insure good lubrication in the hottest, driest location.



**THE FINISH MUST BE RIGHT**

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# SAE National Diesel Engine Meeting

By Kenneth Rose

OPTIMUM stroke to bore ratios, loop-scavenged two-stroke engines, and the correlation of laboratory procedures with actual service conditions were among the subjects of many interesting papers devoted to Diesel engine design and testing presented at the National Diesel Engine Meeting of the Society of Automotive Engineers. Held in Chicago last month, the conclave drew a large and enthusiastic attendance.

K. J. Fleck, Research Dept., Caterpillar Tractor Co., gave the results of tests with single-cylinder engines having variations of stroke and bore. In his preliminary remarks he pointed out that while the Diesel has historically been a long-stroke engine, there have been considerable differences of opinions as to the best stroke to bore ratio. In order to establish results from an experimental base, rather than from theory, seven different engines were designed and tested, maintaining as much uniformity as possible so that the change in cylinder dimension would be the major influencing factor. All of these one-cylinder engines were of the precombustion chamber type. Two groups of engines were made up, comprising one in which the dimensions of cylinder block, head and bore diameter were fixed, and only the length of stroke changed; and another in which the stroke to bore ratio was the main variable. The physical characteristics of these engines are shown in Table I.

Performance tests with the first group of engines disclosed that: (1) Actual bhp and torque increased with each increase in stroke; (2) Bmep (and bhp/cu in.) was highest for the long stroke engine up to about 1800 rpm, and for the shortest stroke at 2400 rpm; (3) More power at a lower fuel consumption rate could be obtained with the longer stroke; (4) Friction was lowest on the 6.5-in. stroke, 1.27 stroke to bore ratio engine; and that (5) Torque increase characteristics improved with each increase in stroke.

The results obtained from test of the second group of engines were: (1) When the displacement was held nearly constant (range of 153 to 161 cu in.), the stroke to bore ratio of 1.30 gave the best performance of those tested; (2) The 1.45 stroke to bore ratio engine, while performing well, showed excessive friction and a higher rate of power loss at high speeds; (3) The shortest stroke engine was low in friction and also in power, indicating that its overall thermal efficiency was relatively low.

At a symposium on correlating laboratory techniques with product service conditions, R. C. Schmidt, of Cummins Engine Co., Inc., spoke of the necessity to analyze field problems, and include field conditions in laboratory tests. Durability tests must be performed in a minimum time, and accelerated tests should be used wherever possible. Field tests should be run for comparison purposes only, Mr. Schmidt said, but split tests, in which laboratory tests are compared with field tests, provide a positive check under varied conditions.

W. C. Arnold, of the Diesel Experimental Dept., Fairbanks, Morse and Co. described the results of development tests using SR-4 strain gages on cylinder liners and blocks. Results obtained in this way verified the static test trends. Importantly, it was found that thermal stresses are of the same magnitude as the full load dynamic stresses due to mechanical loading, and the need for determining means for their reduction was indicated.

Roger D. Wellington, of the Detroit Diesel Engine Div., GMC, described cyclic testing to simulate service conditions, in which thermal variations, and acceleration loadings are introduced which do not exist in

(*Turn to page* 104, *please*)

**TABLE I**

First Group—Constant Bore—Variable Stroke

| Bore and Stroke | Displacement | Stroke : bore ratio | Surface : volume ratio |
|---|---|---|---|
| 5.12 x 5.28 | 109 | 1.03 | 9 |
| 5.12 x 6.00 | 124 | 1.17 | 8 |
| 5.12 x 6.50 | 134 | 1.27 | 7.1 |
| 5.12 x 7.41 | 153 | 1.45 | 5.6 |

Second Group—"Constant" Displacement—Variable Bore and Stroke

| Bore and Stroke | Displacement | Stroke : bore ratio |
|---|---|---|
| 5.12 x 7.41 | 153 | 1.45 |
| 5.38 x 7.00 | 159 | 1.30 |
| 5.75 x 6.00 | 156 | 1.04 |
| 6.25 x 5.28 | 161 | .85 |

**TABLE II**

| Type of Coach | Carbon Monoxide, scfh | Oxides of Nitrogen, scfh | Formaldehyde, scfh | Hydrocarbons lb/hr |
|---|---|---|---|---|
| Diesel | 2 | 5.4 | 0.24 | 0.47 |
| Gasoline | 194 | 3.8 | 0.17 | 1.24 |
| Propane | 96 | 4.9 | 0.11 | 0.57 |

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# HIGHLIGHTS *of the* Industrial Hydraulics Conference

By KENNETH ROSE

HYDRAULIC systems installed in some off-the-highway vehicles now consume as much as 70 per cent of engine horsepower, when operating at maximum output, Morton M. Coker of Caterpillar Tractor Co. told hydraulic engineers recently in Chicago. He spoke at the 12th Annual Conference on Industrial Hydraulics, which is sponsored by Illinois Institute of Technology and supported by a number of industrial firms.

Mr. Coker described a hydraulic system to meet these high power requirements; it was designed especially for a track-type, tractor-mounted excavator-loader. The system pump is mounted in front of the engine and is driven from the engine crankshaft through a universal joint. The reservoir is mounted beside the driver's seat.

Two directional valves control lift and tilt of the bucket. Cylinders are of the double-acting type. A manifold is mounted outside the tank for using other attachments with the tractor. This manifold can be replaced with a line to carry pump flow to additional externally mounted valves, with return flow from the valves to the reservoir.

The hydraulic pump is of the vane type, in which the pressure on the edges of the vane is partially balanced. A full-flow filter of the impregnated-paper type, nominally 10 microns, is placed between the pump and the valves. Fluid lines of formed tubing are located under the seat and fuel tank. Directional control valves are of the sliding-stem type, with spools for register and body porting for directional control. Check valves are located in each pressure path between valve stem and cylinder to prevent gravity load drop during stem shifts.

Discussing power steering for off the highway vehicles, Ralph M. Lehman, of Ross Gear and Tool Co., Inc., stated that these devices may be classified into three groups: integral power steering gears, linkage booster units, and semi-integral power steering gears.

Integral power steering gears consist of a mechanical steering gear, control valve, and power cylinder. This type is popular with design engineers because the piping is simple, the steering system is reversible, and the unit can be installed as a package. The integral unit can be used to steer weights of 50,000 lb or more, but the entire package would be massive and costly.

Linkage booster units, the type first used for power steering, can be installed easily on existing vehicles. The unit consists of a valve and cylinder, which can be installed as an in-line unit or as an individual assembly. The linkage system is easy to install and to service. It is available for two different applications, both of which require a mechanical steering gear.

The semi-integral type, which has received the least publicity, was given little consideration until recently. In this design, the mechanical steering gear and the hydraulic valve are integral, and the power actuator is installed in the linkage. Some engineers consider it as a combination of the integral and linkage types. It has many of the advantages of both, with the added feature that the valve and steering gear may be standardized for a number of vehicle models.

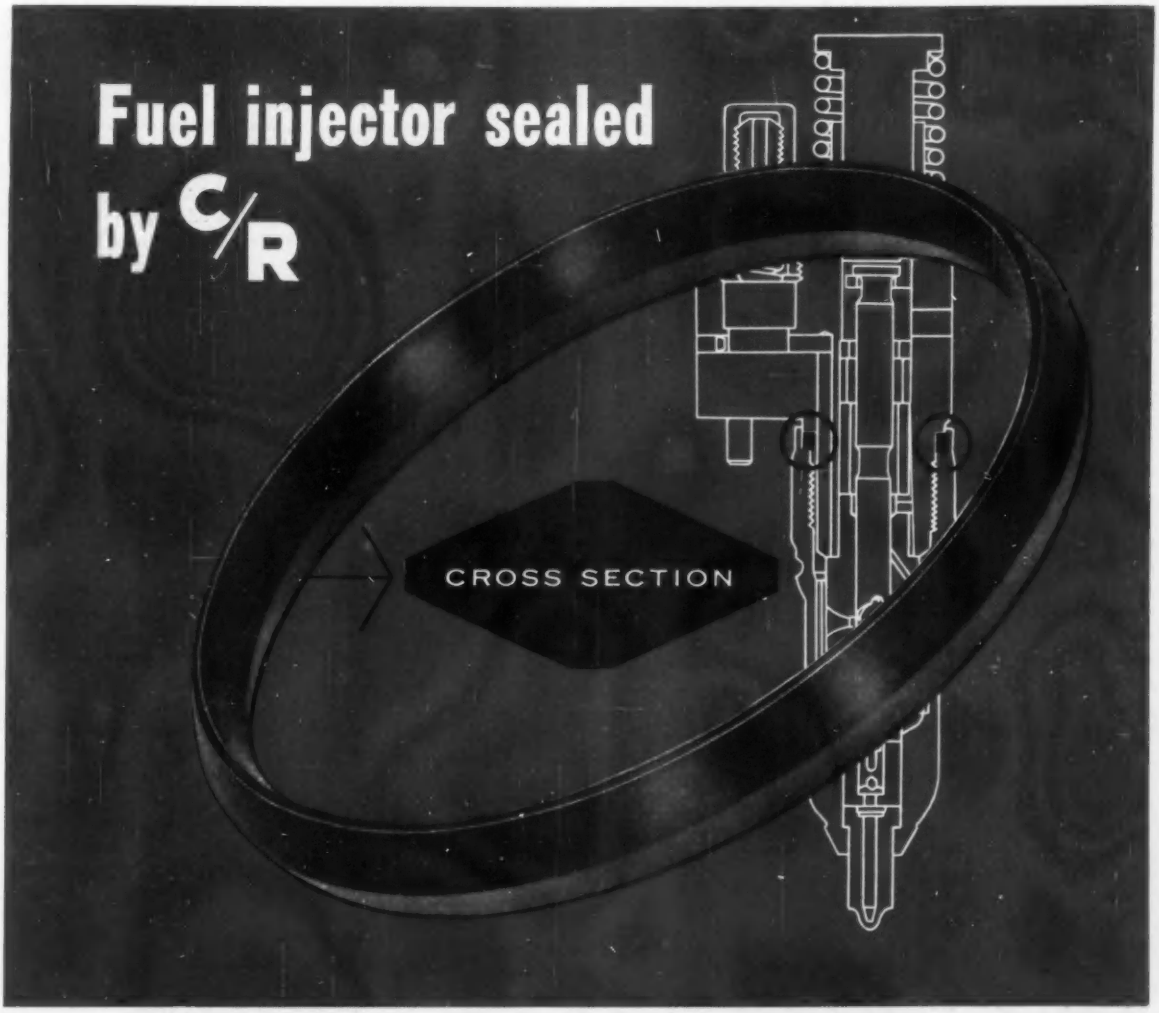
The off-the-highway vehicles for which power steering may be considered are farm tractors and self-propelled harvesters; industrial trucks and specialized equipment; and earthmoving and mining vehicles.

Because every tractor manufacturer has a special steering system all his own, it has been impractical to design standard units for all makes. The power motor has been one of the better solutions, short of redesigning the steering system or the chassis. Most tractor engineers say, however, that the power motor design will not be acceptable on new design tractors. For tricycle tractors, the integral unit has been selected in most cases for new design models. Four-wheel tractors are currently power steered by linkage booster units, integral power steering gears, and semi-integral gears. For low silhouette tractors, better known as utility tractors, the integral unit appears to be the most desirable design, chiefly because of the many accessories that come with this vehicle.

The linkage booster is best suited for self-propelled harvesters because it permits low stressing of the steering linkage and driver's platform. Industrial truck manufacturers have been offering power steering for some time on their 10,000-lb and larger lift trucks—and linkage boosters, both inline and separate valve and cylinder types, have been the choice. The semi-intergral unit and steering booster should have the advantage over integral power steering for future trucks. Specialized equipment such as road rollers, ditching machines, crane trucks, and concrete paving machines can use any of the three systems, depending upon the designer's requirements.

Power steering is standard for practically all earth moving and mining vehicles. Most road graders use the integral unit, but future graders may require a different approach. The off-the-highway truck has

(*Turn to page* 155, *please*)




## ELIMINATES INJECTION NOZZLE LEAKS

Crankcase dilution can be a big headache. But not for one of the leading Diesel manufacturers. They knew that the right injection nozzle seal would cure a major cause . . . and came to C/R Sirvene engineers for help. C/R manufactured this Sirvene (synthetic rubber) part to extremely critical dimensions and physical properties to match the equally precise dimensions of the assembly. Result: no more leakage. When you need a pliable mechanical part compounded to meet critical specifications of heat, pressure, abrasion resistance and molded to the most exacting tolerances, you need C/R Sirvene. C/R Sirvene engineers will gladly cooperate with you in all phases of your sealing problem . . . from design, compounding of the correct oil-resistant elastomers, through laboratory-like control of production quantities. Write for your copy of the new booklet, "Sirvene."

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# AIRBRIEFS

(*Continued from page* 96)

and also elimination of the tracer template storage problem.

## New VTOL Aircraft

Transcendental Aircraft Corp. has completed fabrication of its Model 2 convertiplane referred to as VTOL (vertical take-off and landing). The new aircraft is undergoing pre-flight studies at TAC's Glen Riddle, Pa., plant.

The Model 2 was completed seven months after Transcendental was awarded a contract by the United States Air Force. It is similar in design to the Model 1-G which made over 100 successful flights during 1954 and 1955. It has two rotors at each wing tip. These rotors, with shafts in vertical position, provide direct lift for helicopter flight. The Model 1-G, flying as a conventional airplane, reached a cruising speed of 140 miles per hour with the 250 hp engine initially installed.

VTOL aircraft are currently under development by a number of manufacturers to meet the need of military, feeder airlines and business flying. It is a vehicle which has the speed and range of conventional airplanes combined with the ability of vertical flight.

## Memoirs of a Pioneer

If you are interested in the trials and tribulations of pioneering in the air age we suggest reading "Stormy Life." It is a personal story by Ernst Heinkel as edited by Jurgan Thorwald and published by E. B. Dutton, Inc. Heinkel, a 50 year pioneer and one of the world's foremost designers of aircraft weaves his story from developments in the early days through two world-wars into the jets of today.

# SAE MEETING

(*Continued from page* 100)

constant-speed full-load testing. In the "10-10" cycle, the governor is set for about 10 per cent overspeed, and the thermostat is removed to allow the water to cool during the idle portion of the cycle. The engine is then run for 10 min at full load, then for 10 min at idle speed. This is repeated to failure. The "coffee-stop" cycle consists of 15 min running at full load, with cooling water at 180 F, then stopping the engine. Five minutes later the pump is started, pumping cold water through the engine for 10 min; and at the end of this 15-min shutdown, the engine is started and returned to full load. The "15-second" cycle consists of running the engine for 15 sec at 600 rpm, then for the same period at 2150 rpm, and continuing this alternation. The "railroad brake" cycle consists of bringing the engine to a near stop each 1½ min with a light railroad brake, releasing the brake about ½ sec after it is applied to prevent a complete stall.

"Determination of the Unknowns in Correlation of Laboratory and Customer Test Results," was the subject of a paper by M. C. Gillispie and L. A. Grotto, of International Harvester Co., Construction Equipment Engineering Dept. It outlined a number of case histories, showing the difficulty of developing a testing technique to duplicate field failures, and stressed the importance of determining all the unknown factors in a failure.

The results of a series of eight 500-hr laboratory test runs on submarine Diesel engines were given in a paper "Submarines, Snorkel, and Sulfur," by A. H. Fox, of Standard Oil Co. (Ind.); R. A. Pejeau, Cleveland Diesel Engine Div., GMC; Leonard Raymond, Socony Mobiloil Co.; and L. G. Schneider of Naval Engineering Experiment Station. The tests were intended primarily for determining the detrimental effect of fuels of 0.9 per cent sulfur content under snorkel operation, and for finding means to alleviate damage. It was found that operation under the test conditions resulted in excessive deposits, high ring and liner wear, and corrosion of chrome plate on cylinder liners. Suitable exhaust-valve metallurgy lubricating oil additives, and higher jacket temperatures were suggested as means for improving durability.

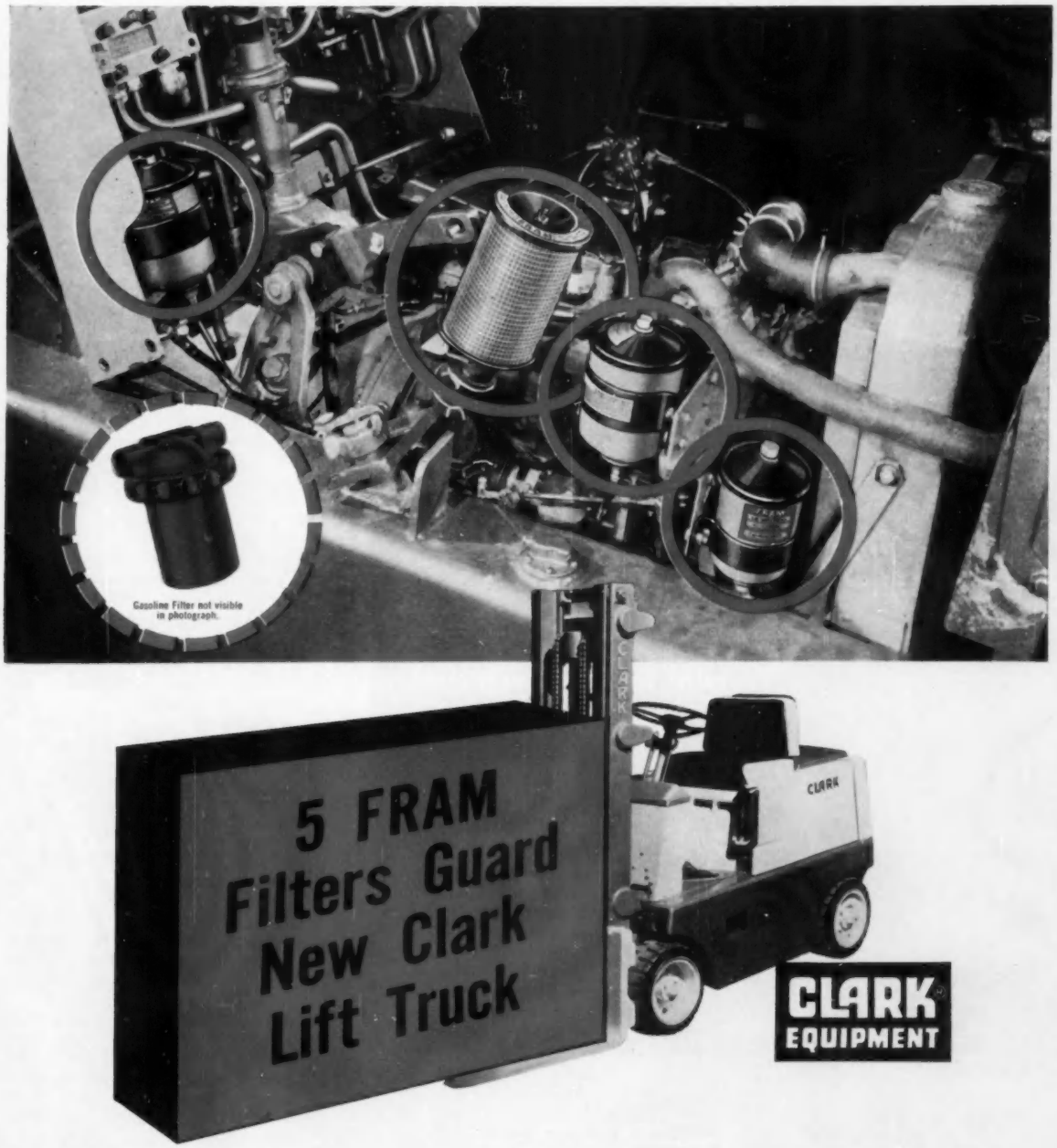
In discussing "Diesel Exhaust Odor," F. G. Rounds and H. W. Pearsall of the Fuels and Lubricants Dept., General Motors Research Staff, presented results of service tests as evidence that many people fail to distinguish between exhaust odor and air pollution, saying that protests against Diesel exhaust odor on the grounds that it pollutes the air miss the point that Diesel exhaust is low in toxic carbon monoxide. The total hourly emission of exhaust constituents, based upon these tests with Diesel, gasoline, and propane powered motor coaches by the Chicago Transit Authority, is shown in Table II.

Physical removal by filters, chemical destruction of the odorous constituents by catalytic mufflers, and masking of the odor by the addition of odorant materials were mentioned as possible methods for meeting the problem.

"High-Speed, High-Output, Loop-Scavenged Two-Stroke Diesel Engines" was the subject of a paper presented by Prof. Dr. Hans List, of Anstalt für Verbrennungsmotoren, Graz-Austria. His remarks were principally centered on one group of two-stroke engines, namely the loop-scavenged type in which the charging process is controlled by the pistons only, without the use of valves. He said that one of the most important processes in the engine is the scavenging process and system employed. "Scavenging system" is understood to mean the arrangement of the inlet and exhaust ports within the cylinder. In the experience of the author, best efficiency generally results when the inlet ports are on each side and the exhaust ports in the center. With good layout, a scavenging efficiency of 90 per cent (charge in the cylinder contains approximately 10 per cent of residual exhaust gases) is obtained. Many of the factors involved can be accurately predetermined by calculation, it was shown, thus shortening development time.

One problem on this type of engine is to obtain sufficient, but not excessive, oil supply to the cylinder walls. Proper distribution is dependent upon accurate design of the sealing areas at the bottom of the piston. At the early stages of development, burning exhaust pipes resulted from excess lubricating oil and oxygen in the scavenging air passing into the exhaust together, and igniting in the exhaust lines.

Loop-scavenged two-stroke engines can be supercharged by (1) the inclusion of an additional valve gear, or (2) with turbo-blowers. The former is usually applied to low-speed engines, while the latter is used with high-duty engines of medium and high power. In the opinion of Dr. List, the supercharged two-stroke loop-scavenged engine can well compete with the highly supercharged four-stroke Diesel, and very likely will be superior in cases where simple design and low weight per rated output are important.

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## New Defense Facilities

SUPPLEMENTING the list of Certificates of Neccesity issued up to October 17, authorizing new or expanded defense plant facilities for the manufacture of automotive and aviation war goods which was published in the November 15 issue, page 184, of AUTOMOTIVE INDUSTRIES, the following additional certificates were announced by the Office of Defense Mobilization, covering October 18 to November 14, inclusive.

The figure appearing in parentheses is the percentage authorized in respect to actual fast tax write-offs.

**AUSTENAL LABORATORIES, INC., La-Porte, Ind.**
Jet engine parts—$2,486,400 (75)

**AVCO MANUFACTURING CORP., Research and Advanced Development Div., Wilmington, Mass.**
Research and development—$9,975,950—(75)

**BOEING AIRPLANE CO., Seattle, Washington**
Military aircraft—$3,413,910 (65)

**DOUGLAS AIRCRAFT CO., INC., Culver City, Calif.**
Military aircraft—$3,663,900 (60)

**FAIRCHILD ENGINE AND AIRPLANE CORP., Fairchild Engine Div., Deer Park, L. I., New York**
Aircraft engine parts—$63,555 (65)

**GENERAL DYNAMICS CORP., Convair Div., San Diego, Calif.**
Research and development—$90,511 (65)

**GENERAL MOTORS CORP., Oak Creek, Wisconsin**
Research and development—$5,650,000 (45)

**GOODYEAR AIRCRAFT CORP., Akron, Ohio**
Aircraft parts—$387,896 (65)

**HUGHES AIRCRAFT CO., Culver City, Calif.**
Aircraft parts—$633,199 (65)

**LOCKHEED AIRCRAFT CORP., Missile Systems Div., Van Nuys, Calif.**
Research and development—$897,617 (65)

**McDONNELL AIRCRAFT CORP., St. Louis, Missouri**
Military aircraft and bomb shelter—$1,796,000 (60)

**RONSON HYDRAULIC UNITS CORP., Charlotte, North Carolina**
Military aircraft parts—$78,391 (65)

**RYAN AERONAUTICAL CO., San Diego, Calif.**
Military aircraft—$23,720 (60)

**SOLAR AIRCRAFT COMPANY, Des Moines, Iowa**
Aircraft engine parts—$550,000 (60)

**TELEVISION ASSOCIATES, INC., Michigan City, Indiana**
Aircraft engine components—$100,000 (50)

**THERM-ELECTRIC METERS CO., INC., Ithaca, New York**
Aircraft engine parts—$81,390 (70)

**THE TRANE COMPANY, LaCrosse, Wisconsin**
Military aircraft parts—$1,221,400 (50)

**UNITED AIRCRAFT CORP., Pratt & Whitney Aircraft Div., East Hartford, Conn.**
Military aircraft engines—$6,686,000 (65)

**UNITED AIRCRAFT CORP., Pratt & Whitney Aircraft Div., North Haven, Conn.**
Military aircraft engines—$202,000 (65)

**UNITED AIRCRAFT CORP., Hamilton Standard Div., Windsor Locks, Conn.**
Research and development—$1,200,000 (65)

**UNITED AIRCRAFT CORP., Hamilton Standard Div., St. Petersburg, Fla.**
Research and development—$576,900 (65)

**THE UNITED TOOL AND DIE CO., West Hartford, Conn.**
Aircraft engine parts—$94,038 (70)


ULTRASONIC METAL CLEANING—BETTER, AT LESS COST!

Ransohoff

automatic indexing double monorail conveyor

with Bendix-perfected ultrasonic unit

Conveyorized Ultrasonic Cleaning System

"Scrubs with Sound" saves time, space and money

• Wash • Rinse
• Ultrasonic Cleaning
• Rinse • Dry

Combining an indexing conveyor with proven ultrasonics, the Ransohoff Conveyorized Ultrasonic system handles "tough" cleaning jobs automatically.

Machined parts with blind holes and intricate recesses, buffed parts of all types and general "hard-to-clean" parts, "come clean" quickly and economically!

Operation of the machine shown above includes: wash, rinse, ultrasonic cleaning (filtered), rinse (filtered) and dry (filtered). Sequence can be changed to suit your work.

Ransohoff Ultrasonic systems clean with a combination of high pressure "walking sprays" and the "scrubbing action" of ultrasonics using *safe, low-cost water solutions.*

Complete Conveyorized System Operating In Our Experimental Department available for Ultrasonic Cleaning of Your Parts. Send Sample for Free Test, or write: **Ransohoff, Inc., 680 North Fifth Street, Hamilton, Ohio.**

Ransohoff

*An old name... the newest ideas*



*Readers of*
**AUTOMOTIVE INDUSTRIES**
*are always well informed*

SUPERIOR stainless strip steels
precise in composition
uniform in handling ease
versatile in application
You can depend upon the fine behavior of Superior Stainless Strip Steels—every step of the way from initial uncoiling in your plant to long and satisfactory product service in the hands of your customers. • We build precise uniformity into every Superior grade: each grade has its specific and profitable field of applications. Let us cooperate on your needs!
Superior Steel
CORPORATION
CARNEGIE, PENNSYLVANIA

# for VOLVO

(a product of superb Swedish engineering)

# ...FOSBOND®

## zinc phosphate rust-protection

Welcome to America, VOLVO! You're a sensation abroad . . . you're becoming the most popular family sports car here! And American buyers can buy the three great VOLVO models* with confidence that all painted metal is well protected against rusting and paint-peeling with Pennsalt's famous FOSBOND zinc phosphate coating.

VOLVO is another quality name in the automotive field being protected by Pennsalt FOSBOND. More and more metal-products manufacturers are turning to Pennsalt know-how to obtain a better start for *their* finish —from cleaning, through surface-activation, to the ultimate in phosphate protection.

WANT TO KNOW MORE about how FOSBOND and Pennsalt's long experience in metalworking chemistry can help you improve *your* finish and reduce your costs? Just call the Pennsalt man, or write directly to Metal Processing Dept. 375, Pennsylvania Salt Manufacturing Co. East: Three Penn Center Plaza, Philadelphia 2, Pa.; West: 2020 Milvia Street, Berkeley 4, Calif. In Canada: Pennsalt Chemicals of Canada, Hamilton, Ontario.

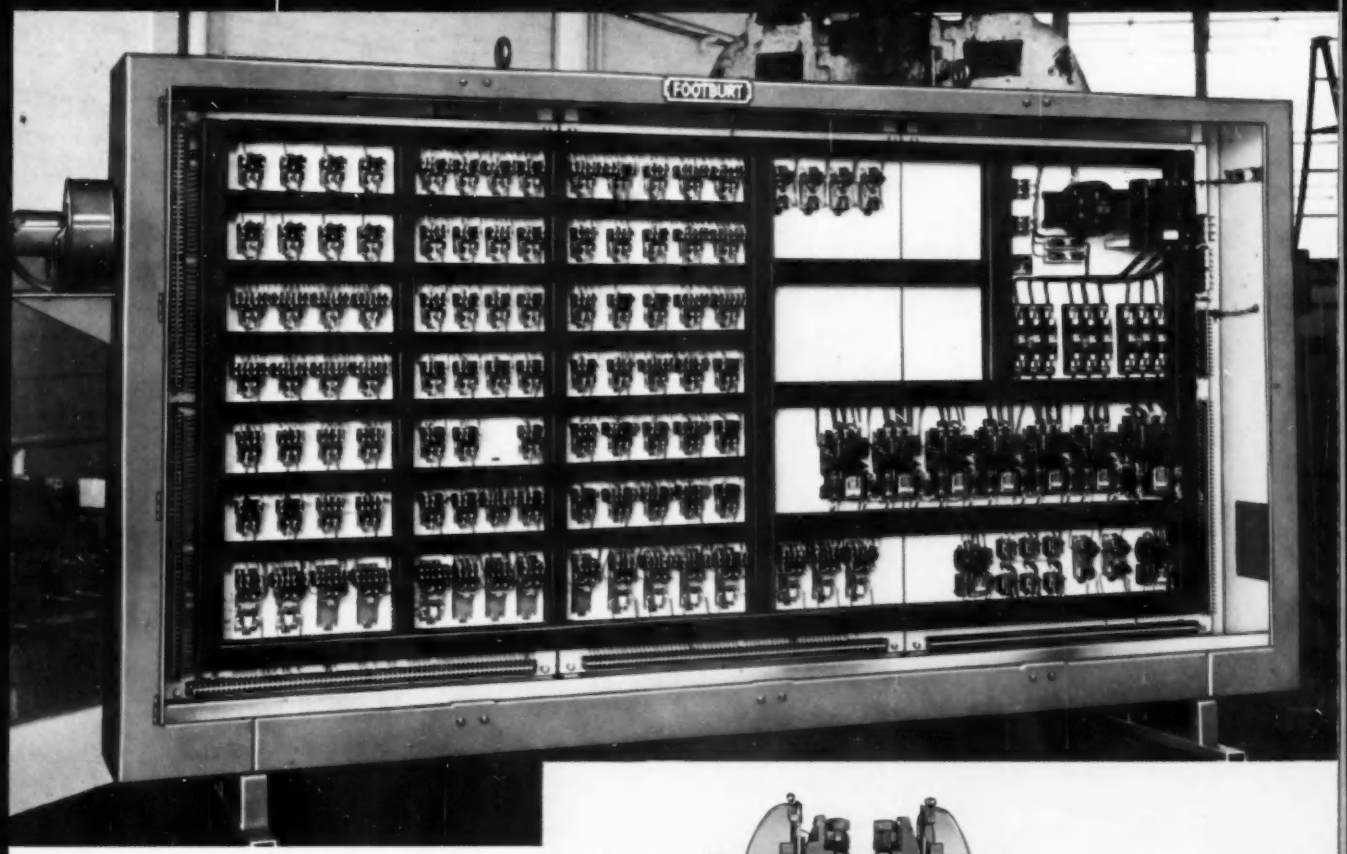
*VOLVO PV444 Sedan, VOLVO "Duett" Station Wagon, VOLVO Sports Car

**Pennsalt Chemicals**

Metal Cleaners • Phosphate Coatings • Cold-Working Lubricants

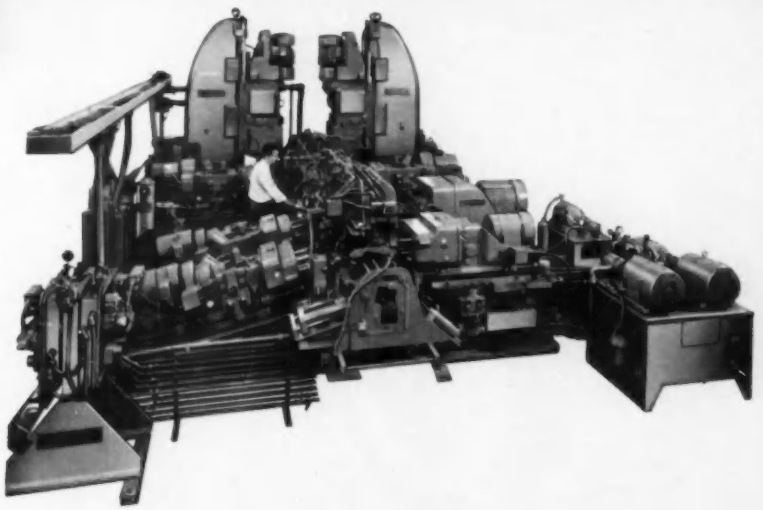
A BETTER START FOR YOUR FINISH

# Another Manufacturer Uses G-E Control For Automotive Industry Machines




General Electric devices in the above panel control a ten-station, 39-spindle, hydraulic feed drilling machine that will be used in the plant of a major automotive manufacturer. Manufactured by The Foote-Burt Company of Cleveland, Ohio, the machine was designed to perform all operations automatically. This machine is one of three sections of a complete transfer line with each section capable of producing 130 parts each hour.

Components of the control panel were supplied by General Electric, and include 9 magnetic starters, 93 machine tool relays, and 6 pneumatic time-delay relays. In addition, 94 General Electric oil-tight push buttons, selector switches, and indicating lights are mounted on a small master control panel and on auxiliary control stations on the machine.

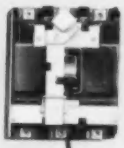


**For a description of the G-E control devices used by The Foote-Burt Company in the panel for this machine, turn the page.**

**GENERAL ELECTRIC**

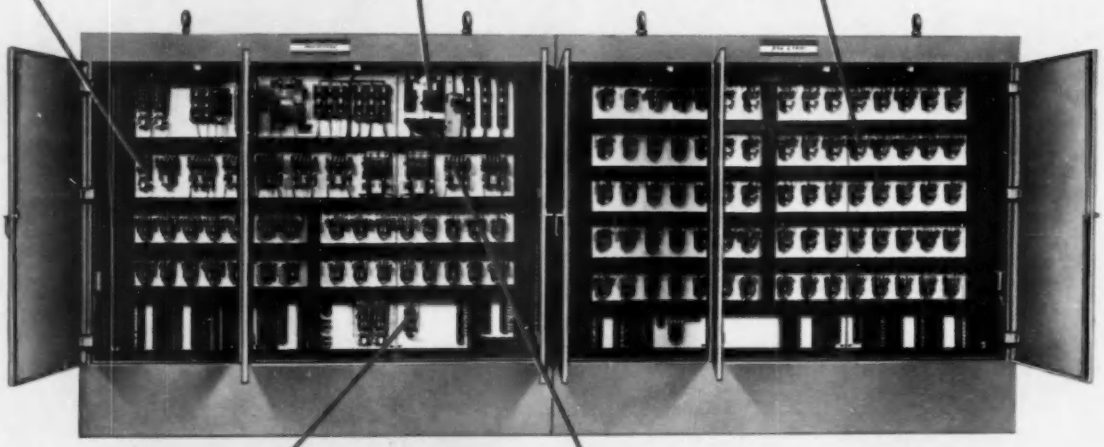
# Another Manufacturer Chooses G-E Control For Automotive Industry Machines

**LATCHED-IN RELAY** is used where it is important to maintain continuity of sequencing after a power failure.



**CIRCUIT BREAKER** provides maximum short-circuit protection, is electrically interlocked with all panel doors.

**6-POLE IN-LINE MACHINE TOOL RELAY** has same mounting dimensions as the 4-pole form, provides easy wiring.



**PNEUMATIC TIME-DELAY RELAY** provides high repetitive accuracy, is easily adjustable from 0.2 to 180 seconds.

**MAGNETIC STARTER,** with contacts easily inspected from the front, has Strongbox coil for longer electrical life.

*Other G-E Devices for JIC Applications*

**STRONGBOX SOLENOIDS,** with coils completely sealed against the entrance of oil, dust, or moisture, are available in a wide range of ratings in both push and pull forms. In addition to five-position mounting versatility, G-E Strongbox solenoids offer longer electrical and mechanical life for JIC applications.

**OIL-TIGHT PUSH BUTTONS** provide maximum flexibility. The many separable operators are interchangeable and the basic contact block can be mounted singly or in combination. Indicating lights and rings are available in six brilliant colors. Oil-tight push buttons are furnished in stations or for panel mounting.

## New General Electric Panel Controls Engine-block Machine

The General Electric Pan-A-trol* panel shown above is one of several recently completed for a major machine tool company. The machine which this panel controls will be used on the engine line of a leading automotive manufacturer.

Designed for high speed production, the machine will bore, turn, face and chamfer cylinder blocks—all automatically.

For highly reliable control on machines like this—and other machines in your plant—specify General Electric. Your G-E Apparatus Sales Office or Distributor can give you complete information on all G-E control devices, or write for Bulletin GEA-6317—CONTROL DEVICES FOR JIC STANDARDS—to Advertising Section 733-19, General Electric Company, Bloomington, Illinois.

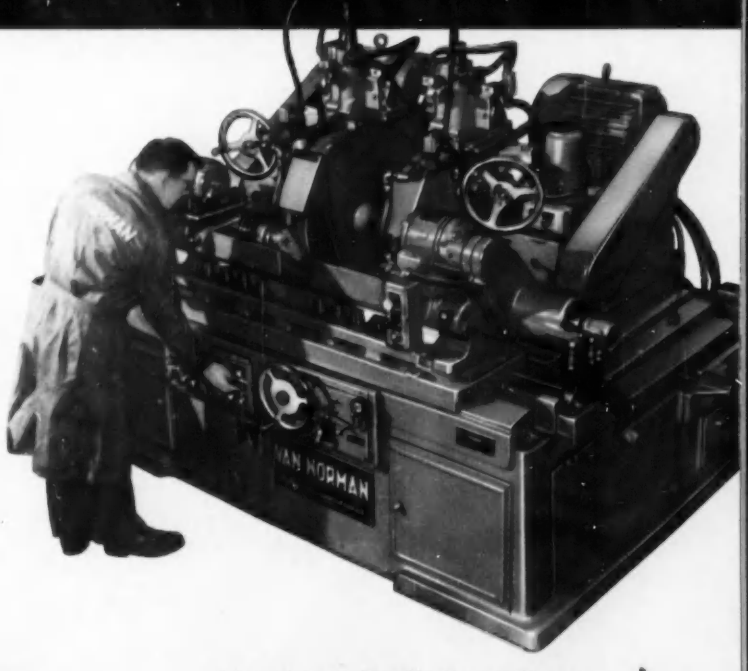
*Trade-mark of General Electric Company

GENERAL ELECTRIC

# Another Manufacturer Chooses G-E Control For Automotive Industry Machines

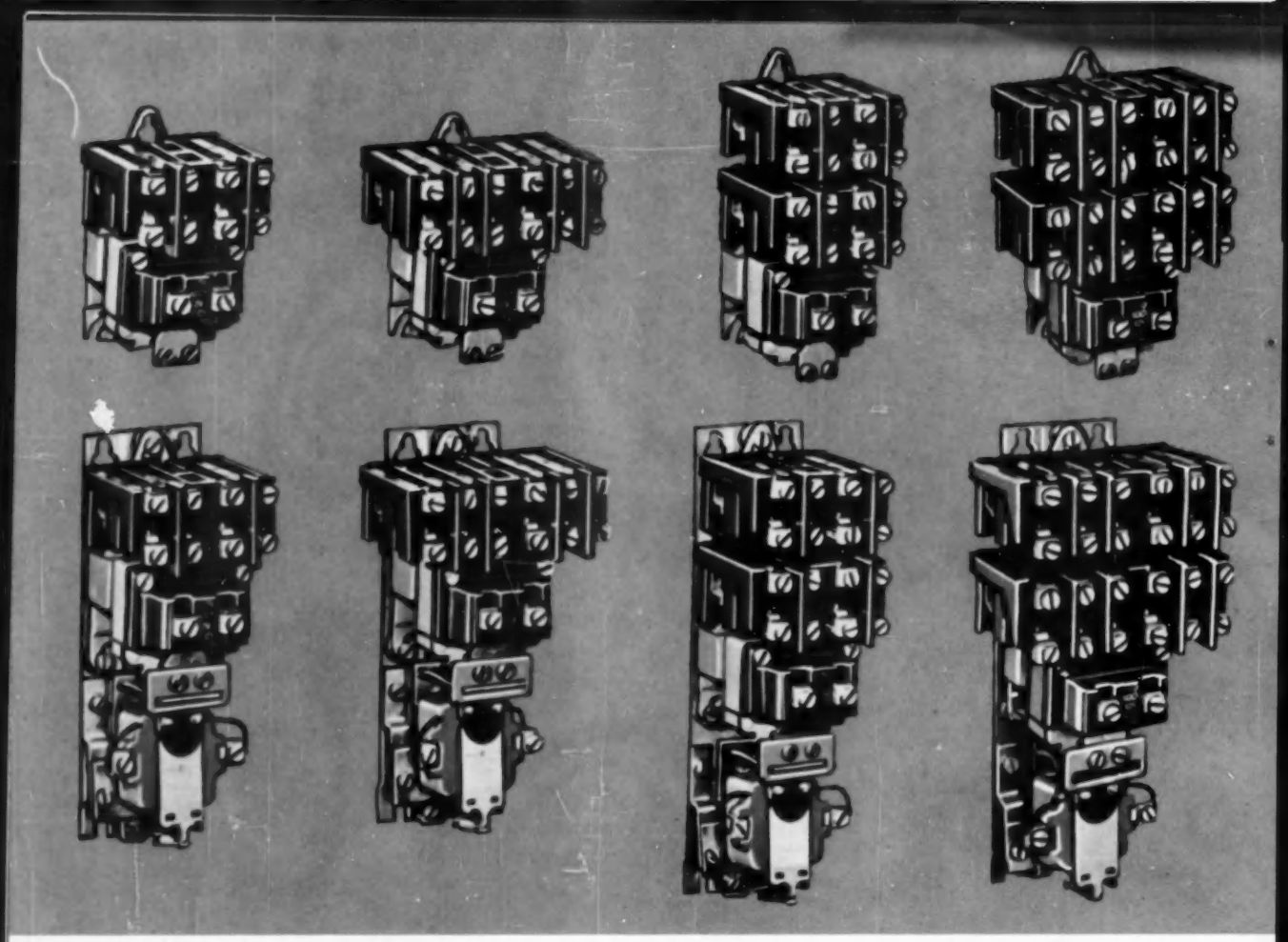
This General Electric factory-built panel provides accurate, reliable control for a new Bowgage Production Grinder, manufactured by the Van Norman Co., of Springfield, Mass. The panel incorporates standard, high-quality G-E starters, relays, switches, and other devices for such functions as interlocking, sequencing, and counting for the automatic dressing cycle.

The control panel circuitry is designed so that this high-production Van Norman machine can grind any automotive part that can be readily chucked. The grinder can remove 0.022 inches on a 1⅝-inch diameter piece, and with operator-initiated automatic clamping can have a new piece ready for grinding every 15 seconds—while holding a 15 micro-inch finish.




GENERAL ELECTRIC

G-E panels for machines like this meet JIC specifications. For some of the devices used in General Electric automotive panels, see the next page.

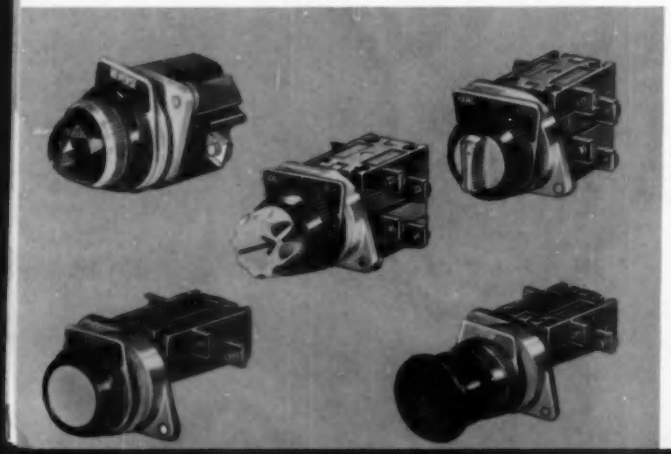


**MACHINE TOOL RELAYS** have Strongbox coils for longer electrical and mechanical life. Available with two through twelve poles, machine tool relays are offered in both standard and latched-in forms to meet most applications. These 10-amp machine tool relays are available in ratings from 110 to 600 volts, and from 25-60 cycles.

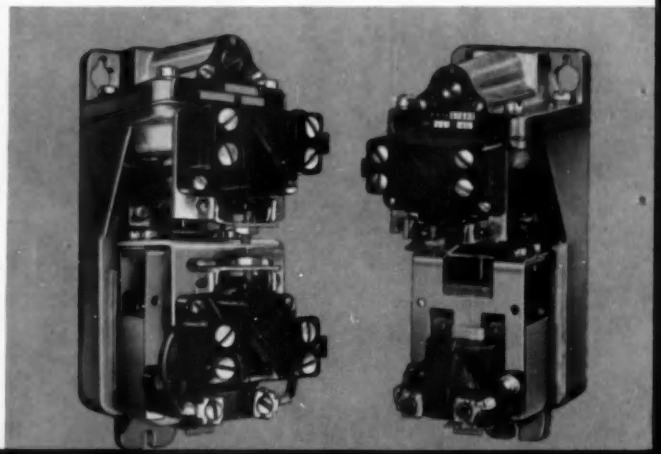
## MORE AND MORE MANUFACTURERS ARE CHOOSING FROM THESE...

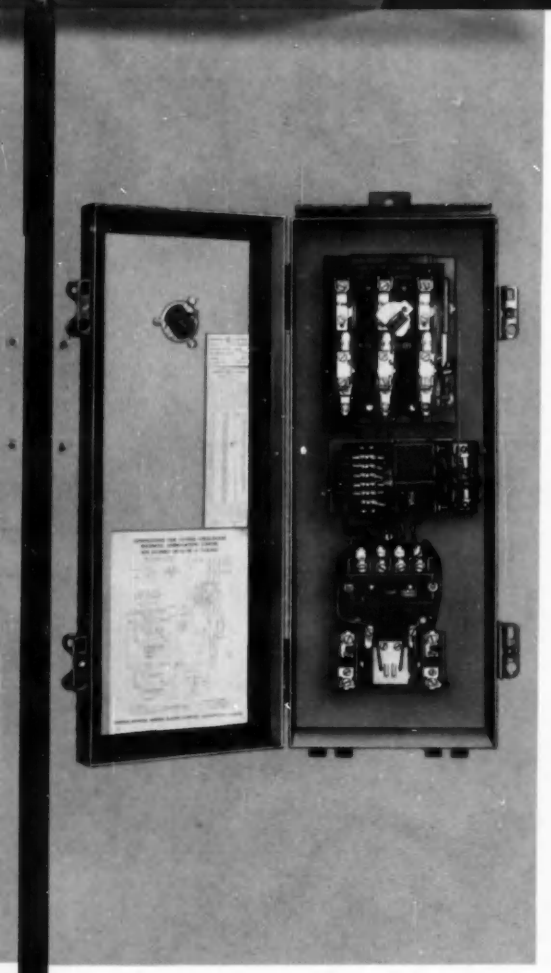
# General Electric Control Devices

**OIL-TIGHT PUSHBUTTON UNITS** are offered in a wide variety of operators, indicating lights, and accessories—either separately or in one- through sixteen-unit stations.

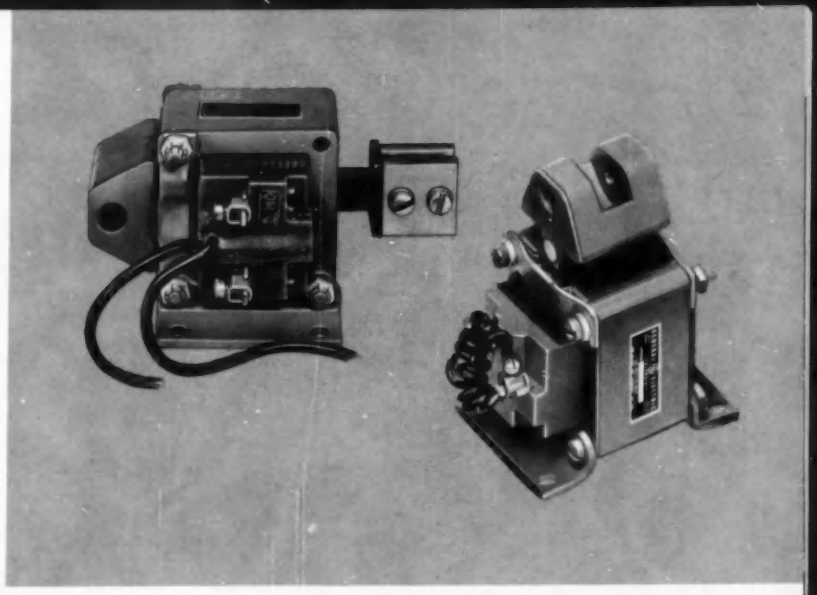


**PNEUMATIC TIME-DELAY RELAYS** are adjustable from 0.2 to 180 seconds. Rigid construction and a filter on the vertical air port on the back assure accurate timing.

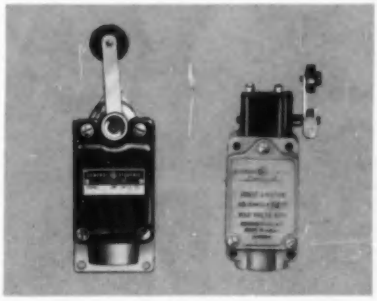




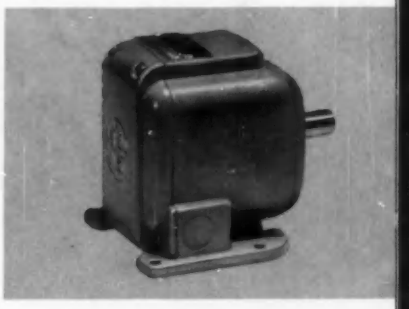
JIC MAGNETIC STARTERS give dependable operation in atmospheres laden with cutting oils, abrasive dust, and moisture.



STRONGBOX SOLENOIDS feature 5-position mounting, small size, long life, and complete rating coverage including both push and pull forms.



LIMIT SWITCHES are gasketed to resist entrance of dirt, moisture, and oil. Fine silver contacts assure longer life.



PLUGGING SWITCHES cut motor stopping time as much as 20:1; save production time.

# for the Automotive Industry

The General Electric control devices illustrated on these pages are built to meet JIC Standards. Designed for the rugged service required for automotive applications, they assure highly dependable performance under the most severe operating conditions.

Your nearest General Electric Apparatus Sales Office or Distributor can give you full details or arrange for you to secure devices for testing.

## GENERAL ELECTRIC

**If you have not already received your copy, send in this coupon for a new bulletin, GEA-6317, GENERAL ELECTRIC CONTROL DEVICES FOR JIC STANDARDS.**

**Advertising Section 733-22, General Electric Company, Bloomington, Illinois.**

**Name** .....

**Company** .....

**Address** .....

**City** ..... **State** .....

# Twin Disc Torque Converters on 14 new Darts provide full hp output, automatic downhill braking!

One of fourteen new Dart Model 25SL, 25-ton end dump trucks, built for the Reynolds Haitian Mines, Inc. Equipped with Cummins NHRBS-600 Diesel Engines, driving through Twin Disc Model CO Torque Converters and Fuller 4MS1440 4-speed Transmissions—the trucks will haul bauxite ore in Haiti.

In building fourteen new Model 25SL, 25-ton end dump trucks for Reynolds Haitian Mines, Inc., Miragoane, Haiti—the Dart Truck Company *standardized* on Twin Disc Model CO, Three-Stage, Truck-Type Torque Converters. This specifically met Reynolds' requirement for a retarding device that would eliminate use of regular service brakes on downhill runs.

These new Darts will carry bauxite ore from the mines located on the plateau above Miragoane, Haiti. The average 8-mile haul (with some as long as 11 miles) is completely downhill, encountering grades varying from 0 to 11%—with an average grade of approximately 5%.

On one of three trucks already delivered to Miragoane—it has been reported that the converter, with its automatic braking, *holds the loaded (97,000 lb.) truck down to 25 mph on an 11% grade.*

Engineered specifically for operations of this kind—the Model CO multiplies torque input up to 6:1. It provides converter downhill hydrodynamic braking action automatically—whenever the accelerator pedal is retarded, by engagement of the new, heavy-duty truck-type 6″ freewheel. With this special *built-in* braking feature, braking effort can actually be exerted *up to 90%* of the engine's rated horsepower.

Twin Disc also offers the Model DF Truck-Type Torque Converter, which also features Converter Braking, and Lock-out Drive for flat, straightaway runs, where fuel-saving benefits of direct mechanical drive can be utilized at high speeds.

Whatever *your* operation—short, steep hauls, or longer, straight runs—Twin Disc has a three-stage, truck-type torque converter to *exactly fit your needs.* Write for Bulletin 501-A.

TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES

**TWIN DISC**
***Torque Converters***

**TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division) Rockford, Illinois**

# Aluminum is Color

## *ALCOA® is Aluminum*

Aluminum can match the iridescent rainbow of a peacock feather or the hard, jet black of onyx. The process is called anodizing and Alcoa can show you how. You can capture the deep, rich colors of porcelain enamel and fix them permanently to aluminum. You can paint, lacquer and enamel aluminum. You can brighten it electrically or chemically so it absorbs colors from its environment. Any metal that will electroplate can be firmly deposited on aluminum. Where is the limit of tints and hues and shades possible with aluminum? Only in the designer's mind, and Alcoa color research keeps his thinking unconfined. Color is a dramatic reason why aluminum is the designer's metal, and Alcoa your source of the new and different.

*Look forward with* ALCOA

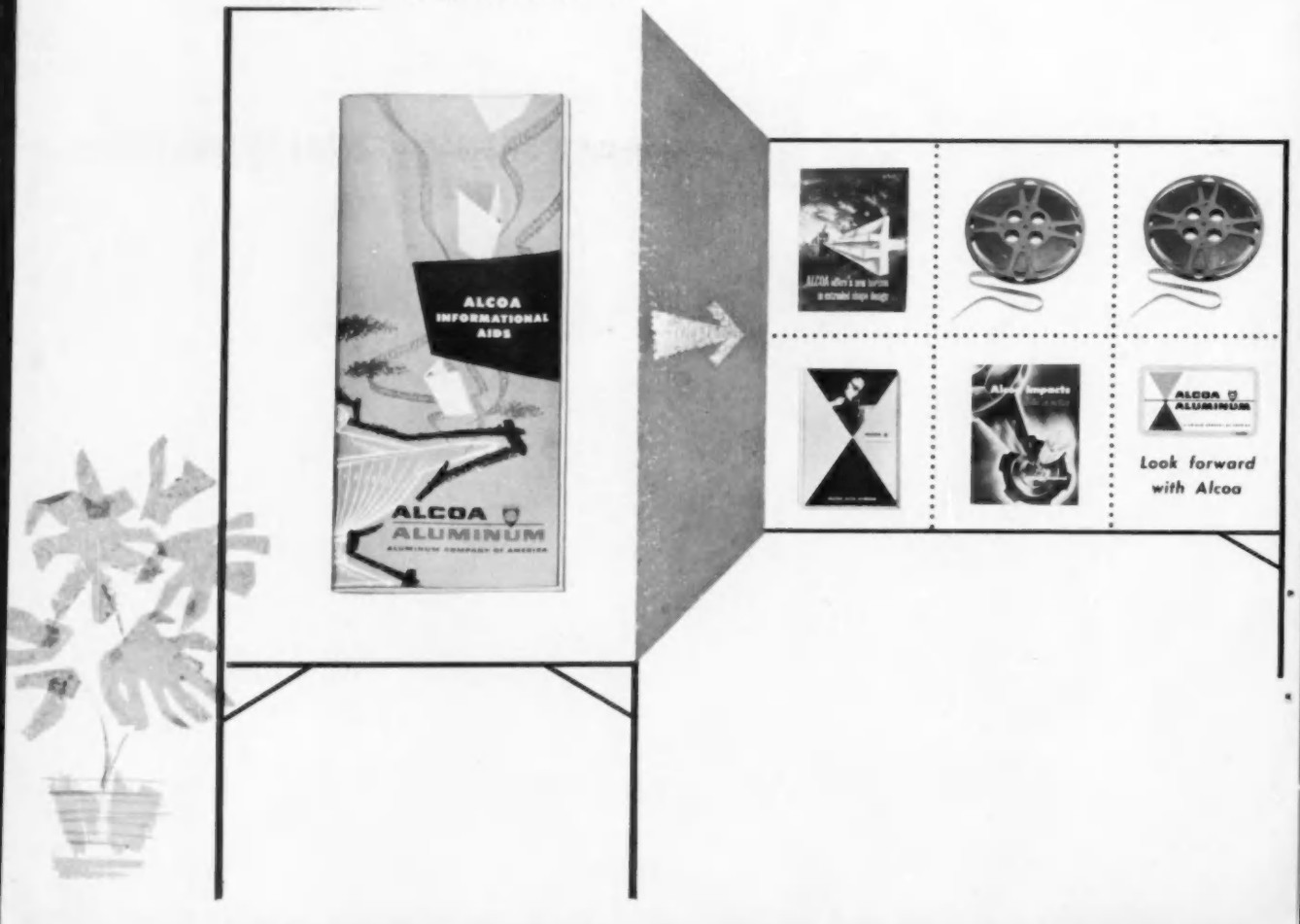
## Learn more about designing in aluminum... this Alcoa Library index will help you

The fruits of 68 years of leadership in development, research and production at Alcoa have been capsuled for you in Alcoa's library of motion pictures and publications.

From the films and publications Alcoa makes available to you, you can check the ground rules for alloy selection. You can evaluate your designs in terms of fabrication methods: castings versus forgings; die castings versus sand, permanent mold or plaster castings; stampings versus machining, spinning or any other method . . . and aluminum can be fashioned by *every* method.

You can determine the best fastening or joining method . . . welding, brazing, soldering, riveting.

To make your selection of films and publications easier, just write Alcoa for your copy of *Alcoa Informational Aids* giving your company affiliation. ALUMINUM COMPANY OF AMERICA, 2193 Alcoa Building, Pittsburgh 19, Pennsylvania.



# SHORTIES

Consumption of motor fuel rose to 54.333 billion gal in 1955.

•

During 1954, manufacturers in the mechanical measuring instruments industry shipped products valued at $792 million, an increase of 87 per cent over 1947.

•

During 1954, manufacturers in the scientific instruments industry shipped products valued at $562 million, an increase of 379 per cent over 1947.

•

The average manufacturing company spends most of the working day paying off the costs of doing business, and only about 19 minutes are left in which to earn profits.

•

A new jet photo-reconnaissance plane developed for the Navy can fly non-stop across the U. S. photographing a continuous 10-mile-wide strip of terrain in less than four hours.

•

Of total U. S. rural road mileage, the percentage surfaced has risen from less than eight per cent in 1904 to more than 60 per cent today.

•

Thirty-nine per cent of the deaths and 35 per cent of the injuries due to motor vehicle accidents in 1954 occurred on Saturdays and Sundays.

•

Business flying is the most rapidly growing segment of general aviation. In 1954 it accounted for 3.918 million hrs, 44 per cent of the total for general aviation, and has more than tripled since 1946.

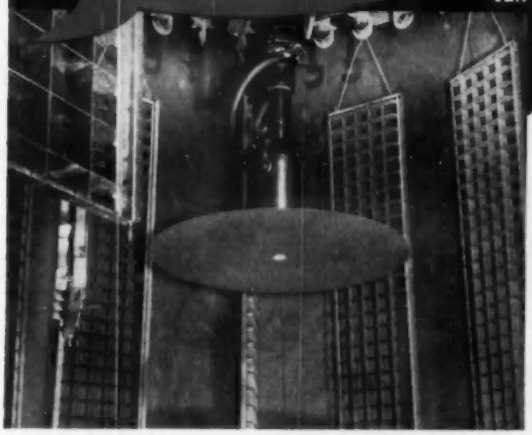
•

Seventy-six million residents of the U. S., about 46 per cent of the entire population, are said to be living in areas which have atmospheric pollution.


*What d'ya mean . . .*

**You're too little to use RANSBURG Electrostatic Spray Painting?**

If your production justifies conveyorized painting, chances are RANSBURG NO. 2 PROCESS can do YOUR painting job better . . . at less cost.



RANSBURG NO. 2 PROCESS *accounts for a 50% savings in paint costs in finishing fluorescent lighting fixture parts for* MELROSE LIGHTING COMPANY, *Philadelphia. Melrose is a small plant employing only 25 people.*

Not only big industrial manufacturers like G. E. . . . Whirlpool-Seeger . . . Westinghouse and Republic Steel, but little plants, too, are using RANSBURG NO. 2 PROCESS in their finishing departments to help keep mounting manufacturing costs in line.

A typical example is Melrose Lighting Company, Philadelphia. They make industrial fluorescent lighting fixtures and employ only 25 people.

Formerly, according to F. Homer Hagaman, owner Melrose Lighting, when their fixture louvres were hand sprayed, they painted only 70 pieces per hour. Now, with Ransburg Electro-Spray, he reports they get over 200 per hour.

Production on the fixture end parts jumped from 400 pieces per hour by hand spray to over 2000 an hour electrostatically—a 400% increase!

Along with improving quality of the work, stepping up production, and cutting labor costs, Melrose is enjoying a 50% paint savings.

Let us show you how Ransburg No. 2 Process can lower YOUR painting costs. Write for our new No. 2 Process brochure on electrostatic spray painting. Numerous production-line examples show how other manufacturers are cutting finishing costs . . . increasing production . . . and improving the uniformity and quality of their work with Ransburg equipment.

*Ransburg* ELECTRO-COATING CORP.
Indianapolis 7, Indiana
RANSBURG

# The BUSINESS PULSE

(*Continued from page* 98)

lets. Judged on this basis, the record appears favorable, at least on surface inspection; for, although there has been a rather considerable net addition to manufacturing and trade inventories over the past year and a half, there has also been an appreciable increase in the volume of sales, with the result that the ratio of inventories to sales has not changed significantly. It is true that this ratio between aggregate inventories and aggregate sales may conceal unbalanced situations in particular areas, but it is nevertheless encouraging as far as it goes.

Even if it could be assumed that current output was being absorbed at a good pace rather generally throughout the economy, there would still exist the basic question of whether the composition of this flow were such as to assure a continuation of favorable business performance over the longer term. It has to be recognized that in any given situation an unbalance may exist between the output of investment goods, on the one hand, and the output of consumer goods, on the other. And while such a relationship may well continue over a considerable period, a time inevitably arrives when the unbalance makes itself clear and when adjustment is necessary. Today some people are beginning to ask whether the present large volume of investment spending — which has been one of the most important bulwarks of this year's boom, perhaps the most important — is fully justified by consumer behavior.

## Retail Sales Sluggish

The fact is that retail trade has been at disappointing levels throughout much of 1956. It was certainly sluggish in the very early months of the year, when sales failed to average as high as in the latter half of 1955. There was some improvement in the period from about May to August, at least in dollar terms, but some backsliding occurred in the autumn months. A slower pace of automobile sales accounted for some part of the autumn decline, and this perhaps was not unnatural, considering the approach of the new model season. But nonautomotive sales also receded, as is witnessed by the fact that department store sales ran at only 123 per cent of their 1947 - 49 average in October on a seasonally adjusted basis, whereas they had been 128 per cent in August.

If this pattern should persist, it could discourage business outlays on new plant and equipment, and this in turn could react negatively on over-all business. Vigorous public interest in new-model automobiles and an exceptionally favorable volume of retail sales in general during the Christmas period would tend to dispel existing concern, but for the time being these are matters about which there can be no certainty.

This question of the adequacy of consumer demand is especially significant just now, for there is evidence that some other forces are currently operating to weaken investment incentives. Most important, perhaps, has been the appreciable rise over the past year or so in such business costs as wages and borrowing rates. These cost increases have clearly been in excess of productivity

ROCKFORD

New!

Air-Flow

Heavy-Duty • Over-Center Clutch —with MORLIFE® Clutch Plate

This new AIR-FLOW type clutch was designed to provide unusual air cooling qualities. Increased torque capacity is obtained with the Morlife clutch plate. Levers are counterbalanced to eliminate self-engaging tendencies, when the clutch is idling. An unique spring-loaded feature greatly reduces frequency of adjustment. For information how this new Rockford AIR-FLOW clutch, with Morlife plate, will improve the operation and increase the on-the-job hours of your heavy-duty machines, write—

See you at the ROAD SHOW CHICAGO Jan. 28-Feb. 2, 1957

"MORLIFE clutch has gone 851 hours without slipping or adjustment."

"MORLIFE clutch going strong after 1695 hours, working in sand."

"MORLIFE clutches last 950 hours longer, without adjustment."

"MORLIFE clutch needs adjustment once a month, instead of daily."

"MORLIFE requires lighter handle pull and one tenth the adjustments."

"MORLIFE pulls harder and lasts six to ten times longer."

"Won't buy a unit that isn't equipped with Durable MORLIFE clutch."

ROCKFORD Clutch Division BORG-WARNER

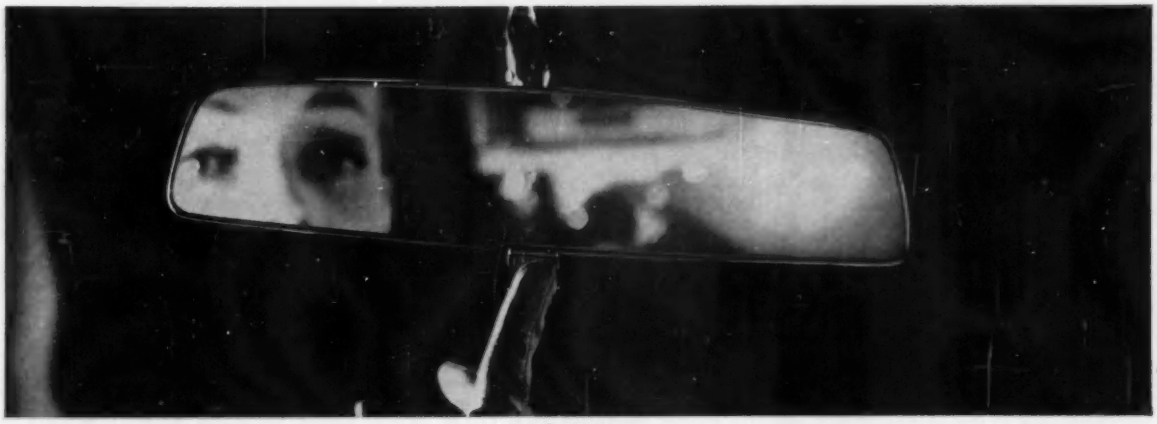
315 Catherine Street, Rockford, Illinois, U.S.A.

Export Sales Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.

CLUTCHES

# GREATER VISIBILITY...

# LESS GLARE...



## NEW
# GUIDE VIEW-FINDER MIRROR!

**NIGHT OR DAY, A FLICK OF YOUR FINGER AUTOMATICALLY PLACES MIRROR IN CORRECT VIEWING POSITION!**

Night or day, a flick of your finger, the glare's gone—the view remains! At night, with Guide's new "View-Finder" Mirror, you place the tab on "night"—automatically you have clear, comfortable nighttime vision! No more blinding headlight reflection from traffic behind you! Daytime, place the tab on "day"—you have a full, undistorted view of the road behind! And that's only part of the "View-Finder" Mirror's beauty! An attractive new stainless steel design adds nearly ten per cent more visibility, which means more *safety*, more *convenience* for you! The Guide "View-Finder" Rear-View Mirror is available now, at your General Motors dealer's.

*Guide Lamp*... BRIGHTEST NAME IN LIGHTS

GUIDE LAMP DIVISION • GENERAL MOTORS CORPORATION • ANDERSON, INDIANA

CASE HISTORY 1

REQUIRED:

A dependable supply of this small, machined electrode to meet customer's quality and quantity needs at reduced cost.

HASSALL SOLUTION:

Hassall-designed re-heading process, involving no critical dimension changes, resulted in a 59% cost reduction to customer.

CASE HISTORY 36

REQUIRED:

Less costly manufacturing method for this small stainless steel fluted pin which cost $19.20 per M as a screw machine product.

HASSALL SOLUTION:

Cold forming by Hassall at a cost of $2.95 per M gave the customer an 85% cost reduction on this part.

# SPECIALTY MANUFACTURER OFFERS SAVINGS ON SMALL PARTS AND FASTENERS

CASE HISTORY 89

REQUIRED:

Customer looking for low cost, high production rate method of producing mandrels for rotary dental brushes.

HASSALL SOLUTION:

Hassall-originated design for cold-heading replaced chamfered end with tumbled, round end; maintained rigid specifications for straightness and made low-cost production possible.

Multiply these case histories a thousandfold and you'll get some idea of the variety of tough problems we crack, and the savings we effect for our customers in the course of a year.

Our cold-heading process—supplemented by secondary operations—imposes amazingly few limitations on the parts and fasteners we can make. Don't forget that we are not limited to "stock" sizes. These illustrations show that Hassall—a specialty supplier—can show you substantial savings, better deliveries and technical assistance on your small parts and fasteners.

Proof? Send us your specifications or write for catalog.

John Hassall, Inc., P. O. Box 2194, Westbury, Long Island, New York.

CASE HISTORY 37

REQUIRED:

Bumper bolt with bonded rubber cap for license plate support.

HASSALL SOLUTION:

The large head on this bolt would ordinarily call for screw machining but the two lugs under the head ruled this out. Progressive cold-heading was Hassall's answer.

# HASSALL

SINCE 1850

NAILS, RIVETS, SCREWS AND OTHER COLD-HEADED FASTENERS AND SPECIALTIES


gains, which appear to have slowed in 1956, with the result that profit margins have been narrowed. Sluggish consumer demand has contributed to this development, since it meant that rising costs could not easily be passed along to consumers in the form of higher prices. If consumer buying continues to be characterized by lethargy, the inroads on profits may widen —a tendency which would not augur well for investment expenditure.

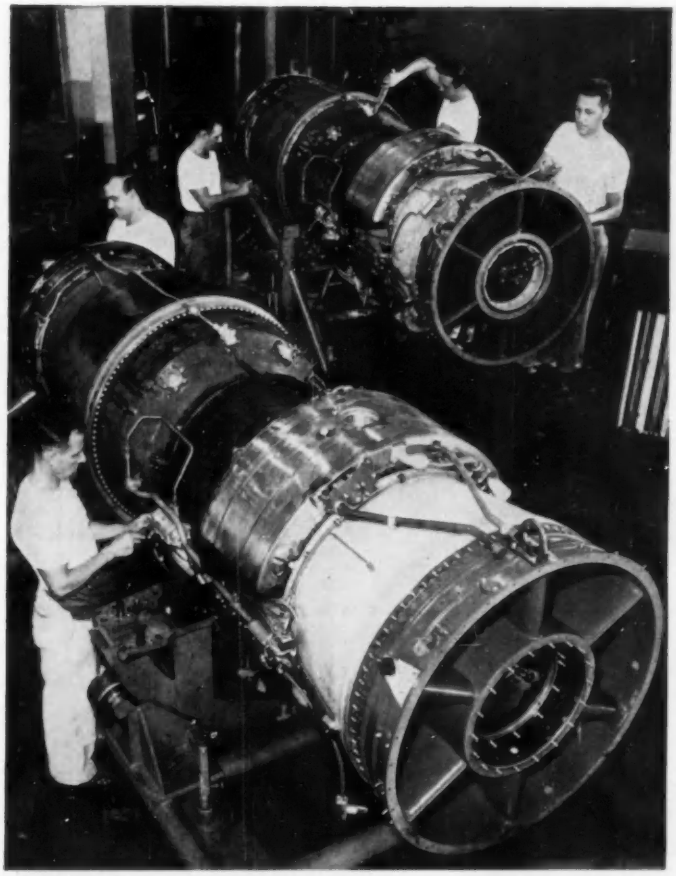
## ON OUR WASHINGTON WIRE

Government controls over materials, prices, and incomes are not in sight for 1957—barring U.S. involvement in war. The U. S. has demonstrated clearly during the past four years that it can sustain a $40 billion-a-year defense program and still not give up a single civilian luxury.

**Preliminary estimates for 1956 indicate that investment in all types of road construction—interstate, primary, secondary, and urban—came to about $4.5 billion. Next year, when the federal highway program gains more momentum, total expenditures should hit $6 billion.**

The corporate tax rate is scheduled to drop from 52 to 47 per cent next April but, as in the past two years, the Eisenhower Administration will ask that the cut be postponed. A drop of 5 percentage points in the corporate rate would cost the Government about $2 billion at the present rate of business activity.

**Nearly 500 government enterprises—including 79 automotive repair shops—that compete with private firms have been closed under the Eisenhower Administration. Competing activities will be kept open, the U. S. Budget Bureau says, when the national security is involved or research is the primary aim.**



*Pratt & Whitney's* **J-57** *Turbojet: The most powerful aircraft production engine in the world is rated in the 10,000-pound thrust class.*

# Why Pratt & Whitney Uses 19 Gear Grind Machines to Guarantee Performance in the World's Most Powerful Aircraft Production Engine

At Pratt & Whitney Aircraft, where finest quality gears and high production are essential to the manufacture of the J-57 Turbojet, 19 new automatic Gear Grind Machines are in daily use. Here is what Pratt & Whitney has to say:

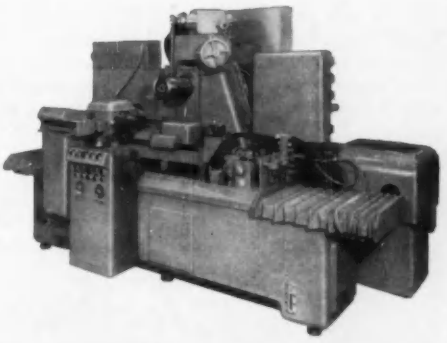
"The new Gear Grind Machines presently used in the aircraft engine division are the first major development in this type of machine since their use at Pratt & Whitney. They were developed in cooperation with Pratt & Whitney engineers to meet the specific and exacting requirements of modern aircraft engine gears. These machines are equipped with a new wheel-trimming feature and a two-speed spindle drive to eliminate burning.

**"Another advantage is the relative ease with which the involute profile can be modified."**

## *YOU'LL WANT TO KNOW MORE ABOUT THESE ADDITIONAL ADVANTAGES FOUND IN THE NEW GEAR GRIND AUTOMATICS*

- Controlled flow of coolant through the grinding wheel insures non-tempered, case-hardened gears.
- Single or double diamond trimmers are used to assure a perfect blend between the tooth profile and the root fillet.
- Automatic trimming of the grinding wheel assures uniformly accurate work.
- Available as fully automatic machines incorporating automatic loading and unloading.

**Write today for comprehensive eight-page brochure which explains the details.**



*For gears up to 36" diameter.*

**The Gear Grinding Machine Company**

56-B

3903 Christopher, Detroit 11, Mich.

*Manufacturers of:*

***The Detroit Screwmatic 750, Automatic Screw Machines. RZEPPA ("Sheppa") Constant Velocity Universal Joints***

# More Government Contract Awards

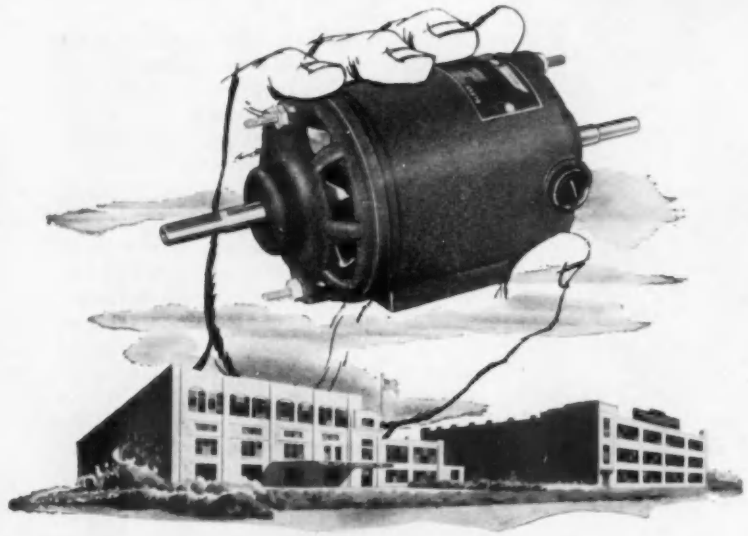
THIS latest list of Government prime contracts that have been awarded covers the period from October 26 to November 27, 1956. Items included in this list are for various types of automotive military equipment, including tanks, motorized gun carriages, trucks, airplanes, automotive components and spare parts, automotive maintenance equipment, etc.

**AMERICAN LaFRANCE CORP., Elmira, New York**
Spare parts—770 ea.—$49,319

**AMERICAN MOTORS CORP., Washington, D. C.**
Station wagons—60 ea.—$91,800

**BENDIX AVIATION CORP., Bendix Products Div., South Bend, Ind.**
Brake assys.—960 ea.—$256,292
Hydrovac assy.—959—$34,035
Struts—31 ea.—$75,701

**BENDIX AVIATION CORP., Eclipse-Pioneer Div., Teterboro, New Jersey**
B-52 trainer—$252,000

**CUSTOM-BUILT USE-ABILITY...**
**for your motor-driven products**

Exceptional performance and dependability go with useability in Lamb Electric Motors because they are:

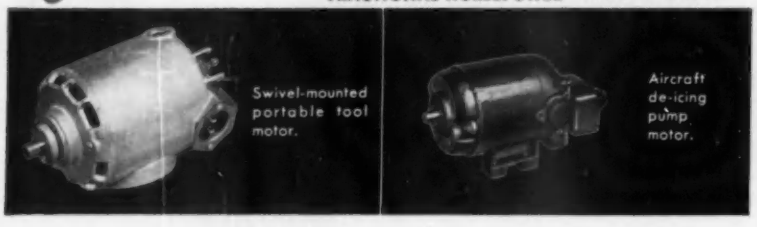
(1) "tailored" to the exact requirements of an application.
(2) built of quality materials by precision-minded personnel.

Our company is equipped and organized to *custom-manufacture on a volume basis;* hence high quality and controlled costs go hand-in-hand.

We would like to discuss these advantages with you for *your* new and redesigned products.

**THE LAMB ELECTRIC COMPANY • KENT, OHIO**
In Canada: Lamb Electric—Division of Sangamo Company Ltd.—Leaside, Ontario

*Lamb Electric*
SPECIAL APPLICATION FRACTIONAL HORSEPOWER **MOTORS**





**BENDIX AVIATION CORP., Scintilla Div., Sidney, New York**
Maintenance parts—various—$292,676

**BOEING AIRPLANE COMPANY, Wichita, Kansas**
Facilities for the production of Bomarc—$10,750,000
Service and assistance in support of B-52 field modification—job—$400,000

**BUTLER MANUFACTURING CO., Kansas City, Missouri**
First article—type L-6 oil service truck, spare parts, maintenance tools—$1,869,591

**CATERPILLAR TRACTOR CO., Peoria, Ill.**
Crawler tractors—4 ea.—$79,254

**CESSNA AIRCRAFT CO., Wichita, Kans.**
L-19A airplanes—$75,000

**CHAMPION SPARK PLUG CO., Toledo, Ohio**
Maintenance parts—various—$78,461

**CHRYSLER CORP., Detroit Universal Div., Dearborn, Mich.**
Automotive spare parts—2498 ea.—$64,049

**CLARK EQUIPMENT CO., Jackson, Mich.**
Wheel assembly, tractor—590 ea.—$27,140

**CLARK EQUIPMENT INT. C. A., Construction Machinery Div., Benton Harbor, Mich.**
Tractors—6 ea.—$87,475

**CONTINENTAL MOTORS CORP., Muskegon, Mich.**
0-470-4 engines—$28,777

**COOPER TIRE & RUBBER CO., Findlay, Ohio**
Tube, 6.00x16; tube, 8.25x20; tube, 9.00x20; tube, 7.50x20—45,062—$104,520

**DANA CORP., Toledo, Ohio**
Shaft, propeller transfer case for truck, 2½ ton, 6x6—$94,086

**THE DAYTON RUBBER COMPANY, Dayton, Ohio**
Tire, 9.00x20—1000 ea.—$43,930

**DETROIT BEVEL GEAR CO., Detroit, Michigan**
Shaft assy., propeller front w/univ. joints—6891 ea.—$75,456
Automotive spare parts—3592 ea.—$59,860

**DIAMOND T MOTOR CAR CO., Chicago, Ill.**
Truck tractor, 5-ton, 6x6; truck chassis, 5-ton, 6x6—1783—$19,015,286

**DOUGLAS AIRCRAFT CO., INC., Long Beach, Calif.**
Phases II and III of B-66 aircraft—$557,596

**ELASTIC STOP NUT CORP. OF AMERICA, Union, New Jersey**
Nut—55,000 ea.—$110,699

**ELECTRIC-AUTO LITE CO., Toledo, Ohio**
Unit gage, sending, engine oil pressure, for truck, 2½ ton, 6x6—$76,619
Batteries—18 items—$57,621
Spark plugs—42,975 ea.—$52,430

**THE FAFNIR BEARING CO., New Britain, Conn.**
Ball bearings—various—$96,196
Bearings—40,900 ea.—$38,855

**FAIRCHILD ENGINE AND AIRPLANE CORP., Fairchild Aircraft Div., St. Augustine, Fla.**
IRAN maintenance and modification of B-26 type aircraft—$640,867

**FARGO MOTOR CORP., Washington, D. C.**
Light trucks—91—$162,914
Bus, B.O.C., 37 passenger—550 ea.—$2,374,184

(*Turn to page* 126, *please*)

# 7 Big Advantages!

## in this

This 113' pre-enameling machine was dry cycling four days after delivery. Capacity 100 100-lb. racks per hour. Overall height of lift only 13'.

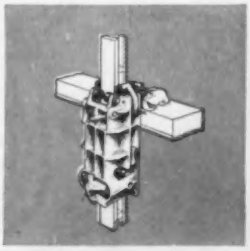
# WAGNER PRECISION AUTOMATIC

- INCREASED LOAD CAPACITY
- PRACTICAL FLEXIBILITY
- LOWER PRODUCTION COSTS
- REDUCED MAINTENANCE
- 100% USER ADJUSTABILITY
- SIMPLIFIED INSTALLATION
- IMPROVED PLATING QUALITY

**This modular precision electroplating machine is a big subject. Please send for our technical bulletin, learn all the facts, compare—or call the Wagner Man in your area. He'll study your problems and help you achieve better plating at lower costs.**

Any day of the week you'll see us lift a 3200 pound automobile with the elevating mechanism of our standard automatic plating machine. That's just to dramatize the dynamic lift capacity of our modular type machine. This excessive capacity simply means that deflection under normal loads is minimum, thus strain on alignment mechanisms is eliminated, wear and downtime is reduced to the vanishing point. Your own personnel—any mechanic—can make precision adjustments of critical transfer members, including the main lift boom, carrier lift angle assemblies and carrier rail support brackets. Maintenance is simple as standard gear racks and pinions are used throughout the entire elevator mechanism (altho capacity can be increased 50% by substituting our heavy duty rack). Hardened guide rollers have positive lubrication—or central lubrication may be installed at low cost.

Here's how you get low cost installation and servicing, even later alterations. All details are interchangeable, precision drilled and machined, preassembled. Our modular design permits easy lengthening or shortening for long term production changes; parts, assemblies, even sections may be replaced. Every part is drilled, reamed, tapped and milled in special co-ordinated fixtures; sections are assembled in giant jigs for fool-proof self-aligning. A single hydraulic power unit interconnected to two hydromotors with micro adjustment of acceleration and deceleration permits work carriers to be lifted, transferred and deposited gently without jarring or loss of parts.



**Typical pre-assembled single station elevator housing ready for bolting through jig-drilled holes in main carriage. Note adjustable roller guide brackets.**

**400 MIDLAND AVE., DETROIT 3, MICHIGAN**

CHICAGO • CINCINNATI • CLEVELAND • INDIANAPOLIS • NEW YORK • ROCHESTER • GRAND RAPIDS

Wagner BROTHERS INC.

UNITED STATES / A SINGLE **TRANSFLEX** PRESS WITH MULTIPLE SLIDES

## How Two Automotive Companies Produce Wheels AUTOMATICALLY with . . .

The TRANSFLEX press above is built on the modular principle. That is, if major changes in production are called for, the units comprising this machine may be rearranged, split up, or added to so that a completely different production system may be constructed from this basic machine.

However, ordinary design changes are taken in stride by this machine. The feed is TRANSFLEX. By simple adjustments, the machine can be set up to run parts of different size and shape.

All operations from the blank to the finished part are automatic including feeding, unloading and the movement of parts between stations. The economy of this machine is clearly demonstrated when it is understood that a single drive operates the four slides. A single mechanism handles the pieceparts from start to finish. With all actions powered by a single drive motor, the press operates continuously. Maximum output is achieved and less maintenance is required.

TRANSFLEX can give you press automation *for a variety of parts.* Modular construction can give you a completely automatic transfer feed press without fear of long range obsolescence.

# CLEARING PRESSES

CLEARING MACHINE CORPORATION

ENGLAND / AN INTEGRATED **TRANSFLEX** LINE WITH SEPARATE PRESSES

# TRANSFLEX

Production requirements for the British firm that uses the press shown above dictated a high degree of flexibility and a more difficult-to-predict schedule for the future. This firm, a contract manufacturer, produces wheels for numerous European automotive firms. They wanted to have a part time automated press line which could be used intermittently as independent machines.

Their Clearing Transflex line gives them the versatility for manufacturing many types of wheels merely by changing settings of the feed mechanism. Each press has its own individual feed which is hydraulically driven and electrically synchronized with the entire line. If necessary this line may be added to or run as a three-press or a two-press line depending on requirements. Or, if necessary, the presses may be operated independently, either manually or automatically.

Both presses on these pages are fine examples of the way Clearing engineers can design TRANSFLEX (transfer feeding plus flexibility) to meet the specific requirements of any manufacturer.

Find out what forward-looking Clearing engineering can do for your manufacturing operation. Call Clearing today.

USI CMC CLEARING

*division of U.S. INDUSTRIES, Inc.*

THE WAY TO EFFICIENT MASS PRODUCTION

6499 WEST 65th STREET, CHICAGO 38, ILLINOIS HAMILTON PLANT, HAMILTON, OHIO

# F.O.S. INDUSTRIAL TAPE

REG. U. S. PAT. OFF.

**Quality Controlled by the Strontium 90 Isotopic Process**

F.O.S. is processed to provide uniformity of product *and* performance, controlled by the unique Strontium 90 Process.

Denser, smoother, more consistent adhesive coating. Try it. Write on your letterhead for *free* F.O.S. samples.

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**F.O.S. INDUSTRIAL TAPE DIVISION**
**THE SEAMLESS RUBBER COMPANY**
**NEW HAVEN 3, CONNECTICUT**

SR SEAMLESS


(*Continued from page* 122)

**FOOD MACHINERY AND CHEMICAL CORP., Riverside, Calif.**
Landing vehicles tracked, LVTRI—14 ea.—$1,630,930

**FORD MOTOR CO., Ford Div., Washington, D. C.**
Trucks—655—$999,907
Automobiles—828—$1,356,738
Trucks, combination grain and stake body—50 ea.—$132,030

**FORD MOTOR CO., Dearborn, Mich.**
Implementation for production of J57-F-9 turbojet aircraft engines—$2,500,000

**FORD MOTOR CO., Ford Div., Livonia, Michigan**
Station wagon—828 ea.—$1,382,218

**FRUEHAUF TRAILER CO., Detroit, Michigan**
Three semi-trailers, kerosene tank, 12 ton, 4 wheel—4 ea.—$37,925

**GAR WOOD INDUSTRIES, INC., Wayne, Michigan**
Trucks, bomb service—112 ea.—$879,885

**GENERAL DYNAMICS CORP., San Diego, Calif.**
F-102A aircraft—$23,000,000

**GENERAL MOTORS CORP., AC Spark Plug Div., Flint, Mich.**
Tank spare parts—419 ea.—$27,139

**GENERAL MOTORS CORP., Buick Motor Div., Flint, Mich.**
Preservation, protection, and maintenance of Government property—$244,984

**GENERAL MOTORS CORP., Chevrolet Motor Div., Detroit, Mich.**
Trucks—3951—$8,314,860
Automobiles—5459—$7,029,769

**GENERAL MOTORS CORP., GMC Truck and Coach Div., E. Pontiac, Mich.**
Automotive spare parts—various—$28,764
Truck, tank, water, 1000 gal., 2½ ton, 4x2—59 ea.—$322,907
Truck spare parts, 2½ ton, 6x6—129,472 ea.—$35,175

**GENERAL MOTORS CORP., Harrison Radiator Div., Lockport, New York**
Cooler assy.—3 items—$25,384

**B. F. GOODRICH TIRE & EQUIPMENT CO., Akron, Ohio**
Deicer boots—various—$940,633

**THE GOODYEAR TIRE & RUBBER CO., INC., Akron, Ohio**
Tire, 7.50x20—8732 ea.—$198,653

**GOULD-NATIONAL BATTERIES, INC., St. Paul, Minn.**
Battery, type 4H, 6 volt—4290 ea.—$57,099
Battery—340,000—$436,592

**HAYS AIRCRAFT CORP., Birmingham, Alabama**
IRAN and modification of C-119—$1,500,000
IRAN of B-50 aircraft and modification of B-50 aircraft to the KB-50 configuration—$713,000
IRAN and modification of RB/TB/WB/B-50 aircraft—$400,000

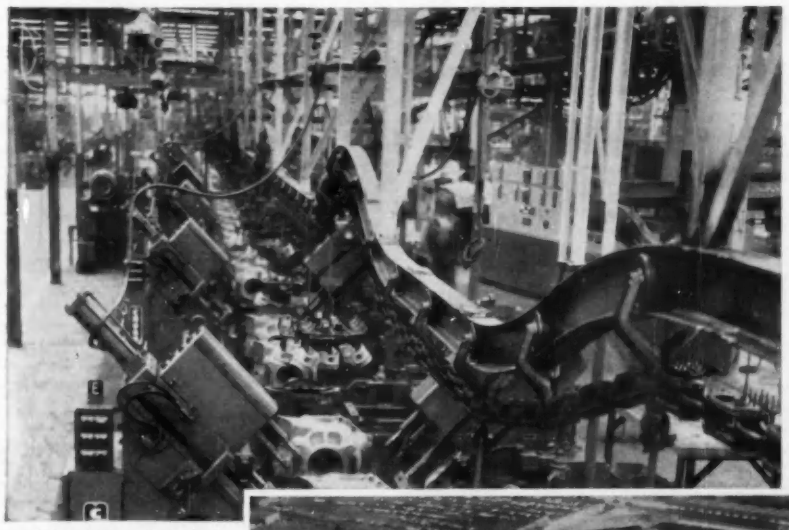
**THE FRANK G. HOUGH CO., Libertyville, Ill.**
Tractor, pneumatic tired four wheel drive, air transportable—28 ea—$383,212

**HUBER-WARCO CO., Marion, Ohio**
Motorgraders—3 ea—$51,653

**INTERNATIONAL HARVESTER CO., Washington, D. C.**
Light trucks—13—$24,667
Truck, tractor, 5 ton, 4x2—168 ea—$868,195
Buses—4 ea—$20,271

(*Turn to page* 128, *please*)

# In the Spectacular PLYMOUTH ENGINE PLANT you see



(Above) View of Plymouth Engine assembly line

VICKERS®
HYDRAULICS
*Wherever You Look*

*Plymouth Engine Plant is 980' long and 500' wide. Indicative of its scope is crankshaft machining requiring 4500 linear feet of automation composed of 385 individual units. Plant capacity is 150 engines per hour.*

In the new Plymouth "Qualimatic" Engine plant you see Vickers Hydraulics on every side. Hundreds of machines in this latest and greatest example of automation are Vickers equipped.

Both builders and users of production equipment appreciate the significant advantages of Vickers Hydraulics . . . advantages that help produce better products at lower cost.

A specific need in the Engine Plant is standardization on a few basic hydraulic units to keep down parts inventories. The Vickers line makes standardization easy. Also desirable are hydraulics in units quickly demountable . . . so that by replacing units, repairs on the job are avoided and costly downtime reduced. Vickers has extensively developed demountable unit construction.

Whether automated or not, more and more plants have more and more Vickers Hydraulics. For further information, write for Catalog 5002B.

**VICKERS HYDRAULICS is used on machines supplied by these Companies to Plymouth Engine Plant**

American Broach & Machine Co.
Barnes Drill Company
Bilt-Rite Tool & Machine Co.
Buhr Machine Tool Company
Colonial Broach & Machine Co.
Crankshaft Machine Company
The Cross Company
Ex-Cell-O Corporation
Fitchburg Engineering Corp.
Greenlee Bros. & Company
Industrial Metal Products
The LaPointe Machine Tool Co.
Landis Tool Company
The R. K. LeBlond Machine Tool Co.
Loos-Bradner Company
Michigan Drill Head Co.
Micromatic Hone Corporation
Micro-Poise Engineering & Sales Co.
Modern Industrial Engineering Co.
The Motch & Merryweather Machinery Co.
Norton Company
A. P. Schraner Co.
The Sheffield Corporation
Snyder Tool & Engineering Co.
Sundstrand Machine Tool Co.
Jarvis B. Webb Co.
The Wickes Corp.
Wilson Automation Co.

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7545

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

(*Continued from page* 126)

**INTERNATIONAL HARVESTER EXPORT CO., Chicago, Ill.**
Crawler tractors—3 ea—$44,760
Tractors—18 ea—$144,194

**LIBBY WELDING CO., INC., Kansas City, Missouri**
Generator set, Diesel engine, trailer-mounted, 40 kw, 60 cycle, 208 volt—51 ea—$145,802

**LOCKHEED AIRCRAFT CORP., Burbank, Calif.**
Additional facilities for test site for jet aircraft—$2,750,000

**LOCKHEED AIRCRAFT CORP., Marietta, Georgia**
C-130A airplanes—$20,000,000
Additional facilities in support of C-130 aircraft production—$37,000
Construction and acquisition of facilities for Weapon System 125A program—$4,510,933

**GLENN L. MARTIN CO., Baltimore 3, Maryland**
Post modification inspection, repair and modification of B-57 aircraft—job—$4,529,551
Facilities in support of the WS-302A program—$842,535

**MINNEAPOLIS-HONEYWELL REGULATOR CO., Aeronautical Div., Minneapolis, Minn.**
Armament control system—$6,883,602

**NORTH AMERICAN AVIATION, INC., Los Angeles, Calif.**
Facilities for production and testing of rocket engines—$7,619,338

**OLIVER CORP., Chicago, Illinois**
Tractors—10 ea—$80,004

**PACIFIC AIRMOTIVE CORP., Burbank, Calif.**
IRAN of C-47/C-117 aircraft—$5,494,256
IRAN F-86A/E and F-86F type aircraft $750,000

**PACIFIC TIRE & RUBBER CO., Oakland, Calif.**
Tire, 7.50x20—20,000 ea—$461,400

**PRICE BATTERY CORP., Hamburg, Pa.**
Battery, storage—$55,455

**PUROLATOR PRODUCTS, INC., Rahway, New Jersey**
Element, hydraulic replaceable micronic line type filter—3 items—$179,303

**MARLIN ROCKWELL CORP., Jamestown, New York**
Bearings—21,700—$244,433

**ROCKWELL SPRING & AXLE CO., Timken-Detroit Axle Div., Detroit, Michigan**
Automotive spare parts—588 ea—$453,471

**THE ROVER CO., LTD., Birmingham, England**
Trucks—22 ea—$39,713

**SOLAR AIRCRAFT CO., San Diego, Calif.**
Acquisition, rehabilitation and installation of machinery and equipment—$300,000

**SOUTHERN CALIFORNIA AIRCRAFT CORP., Ontario, Calif.**
IRAN T-28 aircraft—$100,000

**STEEL IMPROVEMENT AND FORGE CO., Cleveland, Ohio**
Facilities for production of J-57 engine components—$63,000

**STEWART-WARNER CORP., Chicago, Ill.**
Speedometer—25,024 ea—$109,454
Gage oil pressure—27,180—$70,950

**TEMCO AIRCRAFT CORP., Greenville, Texas**
IRAN, fuel tank deseal and reseal and electronic modification of C-54 aircraft—$2,937,675

**THE THEW SHOVEL CO., Lorain, Ohio**
Crane, motor 45 ton, with 100 ft boom, Diesel power plant on truck—1 ea—$89,888

**THOMPSON PRODUCTS, INC., Cleveland, Ohio**
Acquisition, rehabilitation and installation of facilities for J-79 engine program—$5,000,000

**TRICO PRODUCTS CORP., Buffalo, New York**
Motor assy., windshield wiper—4104 ea—$30,373

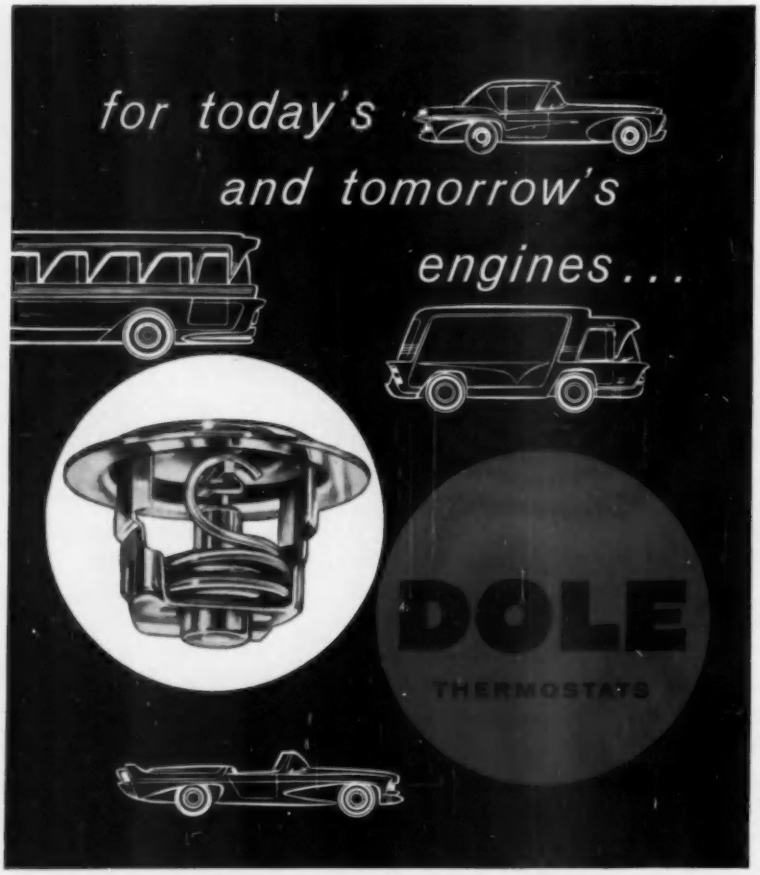
**UNITED AIRCRAFT CORP., Sikorsky Aircraft Div., Bridgeport, Conn.**
IRAN of H-19 aircraft—48 ea—$100,000

**VERTOL AIRCRAFT CORP., Morton, Pa.**
IRAN of H-25 aircraft—13 ea—$75,000

**VICTOR MANUFACTURING & GASKET CO., Chicago, Illinois**
Gasket set, engine overhaul—18,260 ea—$37,980
Gasket set—26,912—$43,059

**WESTERN GEAR CORP., Lynwood, Calif.**
Gear box assy-hyd pump drive—1 item—$198,595

**WILLYS MOTORS, INC., Toledo, Ohio**
Light trucks—56—$119,950
Station wagons—6 ea—$15,638
Trucks and spare parts—1 lot—$16,307
Trucks, audio visual units—3 ea—$16,570
Carrier, light weapons, infantry, ½ ton, 4x4, H274—$1,410,500


these are the reasons why Dole Thermostats are standard equipment on 37 of the leading makes of cars, trucks, tractors, commercial vehicles, industrial and marine engines.

- Positive operation against increased pump pressures
- Good service with all types of antifreeze solutions
- Help maintain best engine performance
- Speed warm-up and get more heat from the car heater.

*Write for information.*

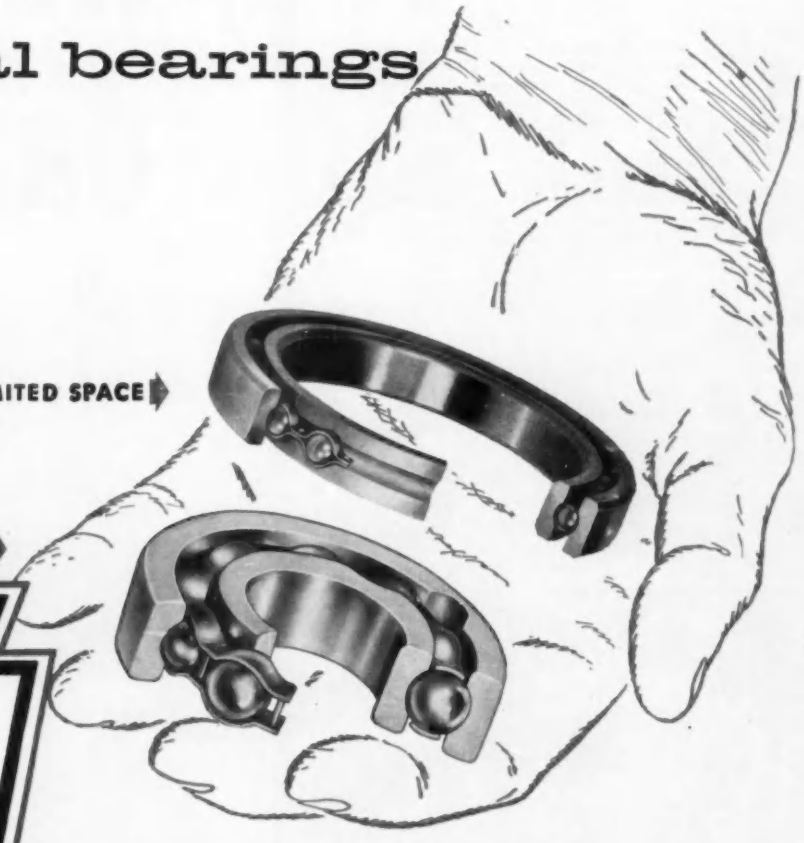
Control with DOLE 1906 1956 50th Anniversary

THE DOLE VALVE COMPANY
1901 Carroll Avenue
Chicago 12, Illinois

*Control with*
DOLE
(TRADE-MARK)
Detroit Los Angeles Philadelphia

# single row...

# radial bearings




BCA

## solve space, weight, and load problems for the manufacturer

Conrad types. Maximum capacity types. Choose the exact type and size single row radial bearings you need from the complete BCA line.

With balls and raceways specifically designed to handle a specific job . . . and made to highest standards of material and workmanship, BCA radial bearings provide outstanding, dependable performance.

When the job calls for *more* than just another bearing, specify the name you can count on . . . BCA. The name is your guarantee.

**ENGINEERS!** Send for a copy of BCA's valuable 100-page "Engineering Handbook." Write on your company letterhead. It's free!

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**BEARINGS COMPANY OF AMERICA**

*DIVISION OF FEDERAL-MOGUL-BOWER BEARINGS, INC.*

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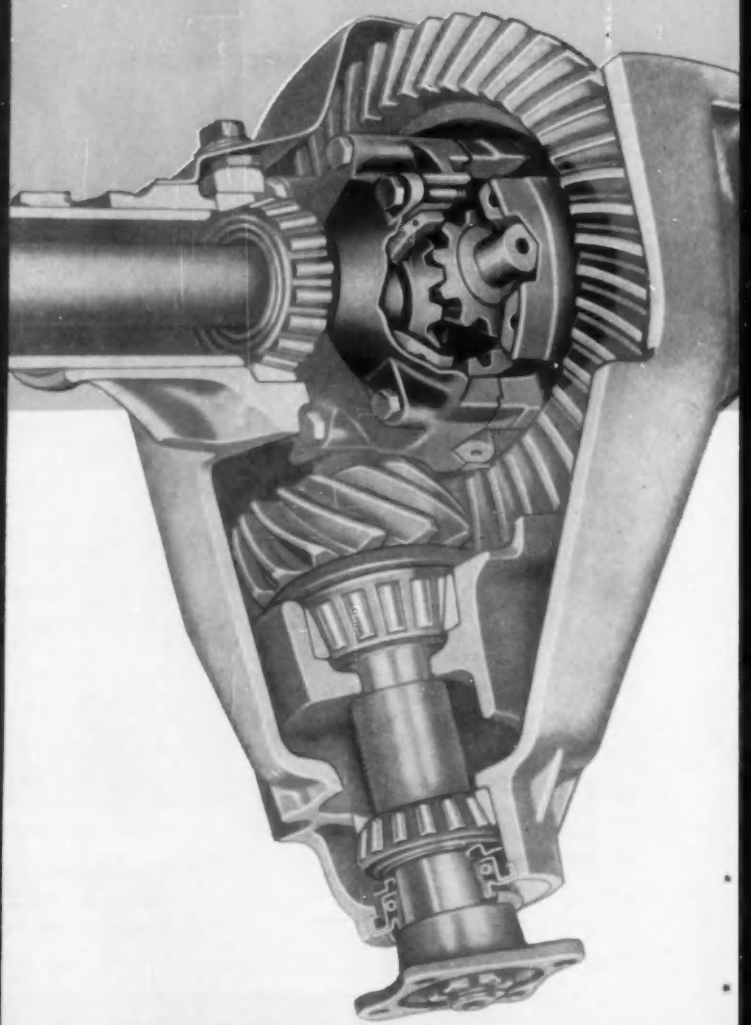
# How the can help

POWR-LOK ends "one-wheel" spin on slippery surfaces. It enables you to demonstrate "pull-away" power that keeps your vehicle moving in snow, ice, mud or sand.

POWR-LOK ends "wild wheels" and wheel hop at rough railroad crossings, bumpy roads, etc. It enables you to demonstrate new standards of safety for passengers and vehicles.

POWR-LOK enables your vehicle to negotiate snow-covered, slick or icy pavements and hills that stall the vehicle with ordinary axles. Ends dangerous "ditching" and exasperating dead stops and standstills.

POWR-LOK helps vehicles keep moving under off-highway conditions that would be impossible to negotiate without this new differential.



**DANA CORPORATION • TOLEDO 1, OHIO**

# POWR-LOK you sell more cars and light trucks

POWR-LOK will put new punch into your sales-promotion!

POWR-LOK is a sales tool that brings eye-opening demonstrations back in style . . .

because *POWR-LOK permits road performance that has never before been possible in cars and light trucks!*

POWR-LOK is a revolutionary new differential. For the first time in any commercially produced axle, it *assures* the delivery of controlled power to *both* driving wheels at *all* times, under all road conditions.

Look at the amazing, impressive demonstrations you can make to prospects with your cars or light trucks, as pictured.

No more "wild wheels" that spin uselessly in snow, ice, mud or sand. POWR-LOK puts the major driving power into the wheel that has the solid, gripping traction!

No more "wild wheels" that spin at high speed when bounced into the air by bumps or holes, and then come down with sudden stoppage, causing dangerous car swerve and unbalance.

The Spicer Thornton POWR-LOK Differential is an exclusive development of Dana Corporation, available either as an individual unit, or as an integral part of Spicer Axles.

Write for brochure illustrating and describing the efficiency and safety of the new Spicer Thornton POWR-LOK Differential.

Spicer

**SPICER PRODUCTS:** TRANSMISSIONS • UNIVERSAL JOINTS • PROPELLER SHAFTS • AXLES • TORQUE CONVERTERS • GEAR BOXES • POWER TAKE-OFFS
POWER TAKE-OFF JOINTS • RAIL CAR DRIVES • RAILWAY GENERATOR DRIVES • STAMPINGS • SPICER and AUBURN CLUTCHES • PARISH FRAMES • SPICER FRAMES

**Autos • Buses • Commercial Vehicles**

A new-style *plastic lens* produced by Lancaster for school buses manufactured by Superior Coach Corporation, Lima, Ohio, offers life-saving features which make these buses *quite superior* from a safety standpoint. Part of a red Caution Light, its distinctive *oval contour* immediately identifies the vehicle, while its practical *convex shape* makes the flasher signal visible from the sides, as well as the front (or rear) of the bus.

Many automotive companies, like Superior, rely on Lancaster "know-how" for automotive optics of the highest quality, plus other custom-made plastic and glass components. Why don't *you* check to see how Lancaster can add greater *safety* to your product, greater *sales appeal* to your line?

Write today for full details regarding Lancaster Engineering, Design and Production Facilities—or send blueprints for immediate action.

Lancaster
glass and plastics
to brighten your product's future

THE LANCASTER LENS COMPANY, LANCASTER 7, OHIO


# What Price Executives?

(*Continued from page* 60)

above the industry average in sales and profit increases. Sales and profit increases in the aircraft industry and airlines, on the other hand, were below average, although the average per cent increase in the compensation of chief executives was greater than in the automotive industry. However, it should be noted that the level of compensation in relation to company size (profits, sales) was well below average in the aircraft industry, and well above average in the automotive industry.

## THE AUTOMOBILE INDUSTRY

The automobile industry achieved its greatest volume in 1955, with seven million cars. When the percentage changes in the industry are averaged, sales show an increase of 27 per cent, while profits soared 74 per cent, both well above performance of industry generally. Pay increases among top executives amounted to double the number of decreases; about a third of the companies in the survey reported no change.

Charts I and II indicate the relationship between the compensation of the chief executive and sales and profits and offer a comparison of compensation figures in the automobile industry and aircraft and airlines with industry averages. On the side axis, levels of executive compensation are indicated; on the bottom axis are scaled profits (Chart I) or sales volume (Chart II). By both yardsticks automobile executives tend to be compensated somewhat higher than the industry average and higher than in the aircraft industry.

The profit chart also shows that as profits rise in the automobile industry, compensation also increases, but at a slower rate. In a few isolated instances, sales for a company in the industry increased without any increase in the compensation of the chief executive officer. But in no case was the pay of the chief executive officer increased if profits did not increase. And by the same token, there was no instance of a decline in prof-

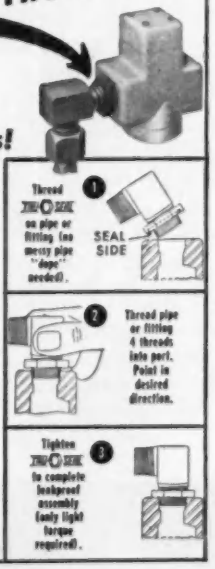
(*Turn to page* 135, *please*)


TRU-O-SEAL
TEFLON SEAL
PAT. PENDING

STOPS PIPE THREAD LEAKS instantly!

**Prevents future leaks!**

TRU-O-SEAL does away with messy pipe "dope" compounds, eliminates damage caused by overtightening of conventional leaky joints, and is immune to ALL known hydraulic fluids and to steam, air, water, solvents, and practically all gases and chemicals. It withstands temperatures from —100° F. to plus 500° F., saves cost and labor of special or welded fittings, and has been fully field tested and proven by leading manufacturers. Comes in ⅛" to 2½" pipe thread sizes.


1
Thread TRU-O-SEAL on pipe or fitting (no messy pipe "dope" needed).
SEAL SIDE
2
Thread pipe or fitting 4 threads into port. Point in desired direction.
3
Tighten TRU-O-SEAL to complete leakproof assembly (only light torque required).

*Write for data and prices*

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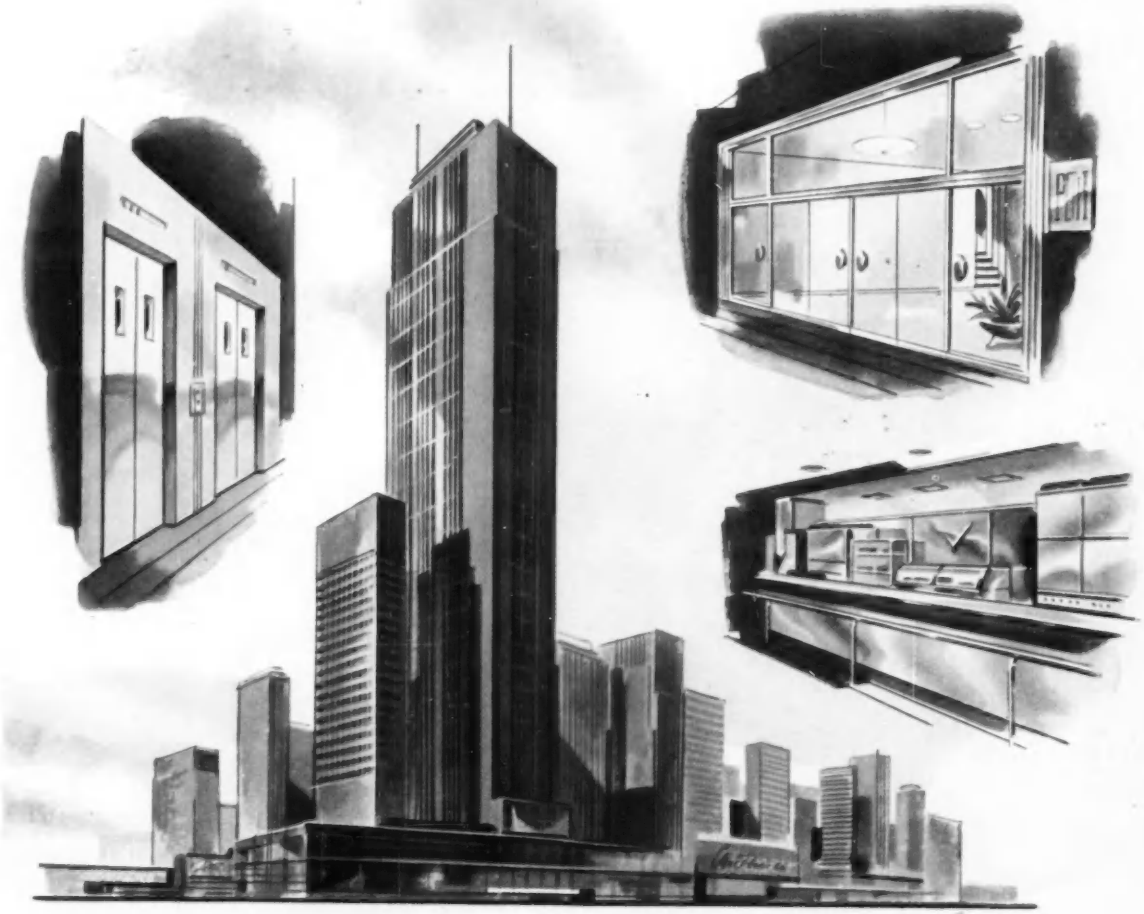
"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.



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# everybody benefits from **stainless steel**

**the architect** specifies long-lasting Stainless Steel for its strength, its beauty and its economy of maintenance. In heavy use areas and for weather-exposed panels and trim, nothing stands up or keeps its smooth finish like Stainless Steel.

**the builder** likes working with Stainless Steel. It is easy to install, does not dent, peel or discolor and presents no problem on matching or replacement.

**the tenants** enjoy living or working in buildings that are bright, clean and attractive because of Stainless Steel.

# Mc Louth Stainless Steel

For the product you make today and the product you plan for tomorrow specify McLouth high quality sheet and strip Stainless Steel

McLouth Steel Corporation DETROIT, MICHIGAN • MANUFACTURERS OF STAINLESS AND CARBON STEELS

# TDA® BRAKES

*if it moves...we can stop it*

## longer life with genuine factory brake replacement parts

Only genuine factory replacement parts are a true match in quality for the original equipment. A major reason for Timken® brake superiority is the care and precision with which every part is produced. These same exacting standards assure equal superiority in Timken-Detroit® brake replacement parts. Each TDA replacement part is rust-proofed, heat-treated or conditioned as required to meet original equipment specifications. This assures the same long-lasting, trouble-free service as the original part.

**Save on man-hours and maintenance!** All TDA factory replacement parts are identical with the original. This assures "original equipment fit" for every installation . . . makes certain replacement is fast and easy.

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Remember, only the authorized dealer or branch of your original equipment manufacturer is equipped and qualified to supply you with the genuine high standard replacement parts you need for efficient maintenance.

For expert consultation on any brake problem, contact the Timken-Detroit Brake Division. A staff of experienced engineers is ready to assist you without cost or obligation.

**For every industrial, agricultural or automotive application where braking is required.**

TIMKEN Detroit BRAKES
ROCKWELL SPRING AND AXLE COMPANY
Accepted TDA Standard
TRADE MARK REGISTERED

TDA Plants at: Detroit, Michigan • Oshkosh, Wisconsin • Utica, New York
Ashtabula, Kenton and Newark, Ohio • New Castle, Pennsylvania

# What Price Executives?

(*Continued from page* 132)

its without an attendant decline in compensation. This may well result from the popularity of profit-based executive bonus plans in the industry.

It is not surprising that, generally, the automobile executives were better paid than their opposite numbers in automotive accessories. In fact, only two of the 30 accessory manufacturers paid their chief executives at a rate that matched the compensation of the lowest-paid of the big three car makers.

Finally, how did the other top management members besides the chief executive officer fare in the automobile industry? Quite well, in terms of dollar amount and at least as well as or a little better than their opposite numbers in industry in general. Table II lists compensation received by the second, third, and fourth highest paid executives in terms of percentage of compensation received by chief executives. To provide a frame of reference, these findings are compared with the 18-industry average. The automobile industry is remarkably close to industry standards in all three ratings.

The exception appears in the compensation of subordinate executives in the top three companies. Second, third, and fourth highest-paid executives in these companies received a significantly higher percentage of their chief executive's compensation than was the case in the rest of the automobile industry or in industry in general.

TABLE II
Percent of Chief Executive's Compensation

| | Automotive | Industry Average |
|---|---|---|
| Second highest paid executive | 73% | 72% |
| Third highest paid executive | 57 | 59 |
| Fourth highest paid executive | 54 | 52 |

## AIRCRAFT INDUSTRY AND AIRLINES

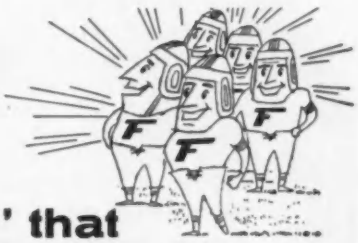
Aircraft manufacturing and airline sales increased 5 per cent and profits increased 14 per cent in 1955, which was below the average for industries in the survey. Only three companies reporting sales and profit dips did not register an upward revision in pay of the chief executive. One-fourth of the companies reported no change and, as indicated in Table I, the average increase was 15 per cent, or somewhat higher than in the automotive industry.

The charts comparing top executive pay with sales and profits disclose that the level of top management compensation in the air industries is lower than that of the automotive industry and industry in general; and that executive pay does not appear to be closely related to profits. As profits rise, the trend line falls away from the industry average. Relating compensation to sales, however, top executive pay in this industry does tend to increase with sales volume. But, as Chart II shows, the average is below industry average.

Other data reinforce these observations. An analysis of profits in this industry shows that over half the companies suffered a decline in profits between 1954 and 1955. Only three companies showed a decrease in the chief executive's compensation from 1954.

A comparison of salaries paid chief executive officer in aircraft manufacturing with those of airline companies reveals that aircraft chief executives, on the whole, were better paid


FASCO



The "Extras" that became "Regulars"

On America's Leading Cars and Trucks

- AUTOMATIC RESET CIRCUIT BREAKERS
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- HYDRAULIC STOPLIGHT SWITCHES
- LOW-PRESSURE INDICATING SWITCH
- SERIES "400" PRESSURE SWITCHES
- HEADLAMP SWITCH

Time was, when Fasco automotive components such as these were considered only as "extras." But they served their purpose so well and contributed so much to over-all performance and customer satisfaction—that one by one, they have been adopted as standard equipment by America's leading manufacturers of cars and trucks . . . a fine tribute to Fasco engineering skill and product dependability.

In the future, as today, Fasco will be ready with "look-ahead" designs to meet the requirements of the automotive industry . . . proof again that it always pays to Consult Fasco First!

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ROCHESTER 2, NEW YORK

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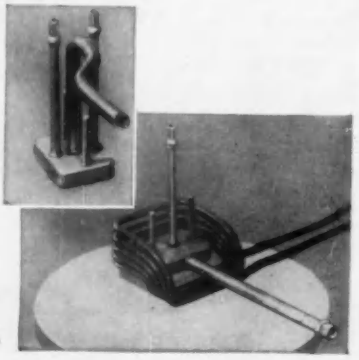
The Lepel line of induction heating units represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating. With a background of half a century of electrical and metallurgical experience, the name Lepel has become the symbol for quality in induction heating equipment embodying the highest standards of engineering achievement, dependable low cost operation and safety.

If you are interested in the application of induction heating you are invited to send samples of the work with specifications of the operations to be performed. Our engineers will process these samples and return the completed job with full data and recommendations without any cost or obligation.

## TYPICAL INDUCTION HEATING APPLICATIONS

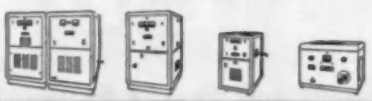
A Lepel installation at Federal Telephone and Radio Co. shown soldering transformer terminals. A precision operation made so simple that even unskilled operators can achieve excellent results on a production basis.



The simultaneous soldering of a group of components within one load coil is an ideal application for induction heating. The assemblies consist of mounting studs and tubes inserted into a machined part together with preformed solder rings. The heating is done so rapidly that there is practically no scaling or discoloration.

**Electronic Tube Generators—1 KW; 2½KW; 5 KW; 10 KW; 20 KW; 30 KW; 50 KW; 75 KW; 100 KW.**
**Spark Gap Converters 2 KW; 4 KW; 7½ KW; 15 KW; 30 KW.**

*WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information.*



All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.


than their counterparts in airline companies. Only one airline head was among 12 highest paid executives out of the total of 35 companies included in the aircraft-airline industry survey. The same relationship of compensation to profits appears to hold true for airline heads as for aircraft: There is little correlation between pay and profits. About half the airline executives covered by the survey seem to have the same compensation despite the fact their company revenues were greater or less than their opposite numbers in other companies.

Second line executives in the aircraft industry appear to compare about equally with industry patterns.

TABLE III
Percent of Chief Executive's Compensation

| | Aircraft and Airlines | Industry Average |
|---|---|---|
| Second highest paid executive | 71% | 72% |
| Third highest paid executive | 61 | 59 |
| Fourth highest paid executive | 51 | 52 |

## CONCLUSIONS

It is interesting that the automobile industry appears to orient its executive compensation to profits and sales while the aircraft industry does not. The automobile industry experienced sales and profit increases well above industry averages in 1955 and the correlation between compensation increases and profit performance was reasonably close. For example, no executive received more compensation unless there was an increase in profits. And the greatest profit increases were paralleled by the greatest compensation increases. This may well result from the profit-oriented bonus plans in the automotive industry.

The aircraft industry does not follow this pattern. The survey shows that executives in aircraft and airlines in a significant number of instances received compensation increases even though profits declined. While analysis did disclose that executives received compensation in amounts varying with size of company, it quite clearly shows that profits alone did not condition their increases. This is not an industry where the fruits of executive effort are generally reflected in as short a period as a year, as is the case in the automobile industry. This holds true for both the airframe manufacturers and the airline companies. Many executive actions in both these industries will have impact on company earnings over a much longer period than a fiscal year. Contracts can be won, tariffs favorably revised, or new certificates acquired which will con-

# *SPECTOR*...Chicago's largest... standardizes on Fuller ROADRANGERS®

Spector Freight Systems, Inc., largest common carrier with home offices in Chicago, is adding 104 new tractors equipped with R-46 ROADRANGERS to bring a total of 257 ROADRANGER equipped tractors to its fleet.

Referring to Spector's 149 tractors now equipped with Fuller 8-speed ROADRANGERS, to 4 tractors equipped with 10-speed ROADRANGERS . . . and to the 104 new units with 8-speed Model R-46 ROADRANGERS, C. L. Lunt, Vice President, Operations, says:

"We have standardized on the ROADRANGER Transmission for better over-all fleet performance and less maintenance . . . resulting, of course, in a substantial dollar savings. Also, our drivers overwhelmingly prefer the semi-automatic Fuller ROADRANGER Transmission."

C. L. Lunt, Vice President, Operations

Spector, whose gross revenues rose from $1½-million in 1945 to an estimated $21-million in 1955, *knows* the value of better over-all fleet performance. Spector drivers prefer ROADRANGER 8 and 10-speed Semi-Automatic Transmissions with:

- **Easier, quicker shifts—all forward speeds in short closely spaced steps between ratios**
- **One shift lever that controls all forward speeds**
- **No gear splitting—all selective gear ratios are evenly and progressively spaced**
- **Higher average road speeds—engines operate in peak hp range with greater fuel economy**
- **Less driver fatigue—⅓ less shifting**
- **Range shifts pre-selected—automatic and synchronized**

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Compact space-and-weight-saving economies permit more cargo to be carried on payload axles. Get full facts on ROADRANGER from your truck manufacturer or truck dealer, now!

**FULLER MANUFACTURING COMPANY**
**TRANSMISSION DIVISION • KALAMAZOO, MICH.**

Unit Drop Forge Div., Milwaukee 1, Wis. • Shuler Axle Co., Louisville, Ky. (Subsidiary) • Sales & Service, All Products, West. Dist. Branch, Oakland 6, Cal. and Southwest Dist. Office, Tulsa 3, Okla.

tribute enormously to a company's long-term earnings in this industry but will not be reflected in short-term profits. This probably explains in large part the lack of correlation between executive compensation increases and company profits in the industry.

## AGMA Symposium on Ultra High Pitch Gears

(*Continued from page* 55)

more numbers have to be added to the AGMA precision scale.

It should be remembered that one of the greatest stumbling blocks in producing accurate fine pitch gears is the careless lack of attention to corresponding accuracy in the preparation of the blanks. It is not possible to make really good gears from inferior blanks.

The high cost of fine pitch gears does not come only from the machine cost, but also from the cutters required. Like all fine tools, fine pitch gear shaper cutters are difficult and tricky to make. The finest pitch gear shaper cutter we advertise to make is 330 D. P. A standard gear of this pitch has a tooth or space thickness of less than 0.005 in. and an addendum of 0.0030 in. This is for spur cutters and helical cutters not over 15 deg helix angle. Cutters of greater than 15 deg helix angle require normal or step sharpening which is practical to about 64 D. P. The finest pitch which we have made in quantities is 240 D. P.

To give some idea of the relative cost of fine pitch spur cutters we will take a look at some cases. We will take as a base a three-in. P. D., 8 D. P., gear shaper cutter. A three-in., 20 D. P. cutter costs 1.2 times as much. A 2½ in. 48 D. P. cutter costs 1.5 times base. A two-in. 96 D. P. cutter costs 1.9 times base. A 1½ in. 120 D. P. cutter costs 2.0 times base. A 1¼ in. 175 D. P. cutter costs 2.5 times base. A one in. 240 D. P. cutter costs 2.9 times base. And a ¾ in. 330 D. P. cutter costs 3.6 times base.

In coarse pitch gear shaping it is not unusual to cut gears as hard as 50 Rockwell C, maybe slightly harder with ultra high speed steel cutters. This is not practical on the ultra fine pitches where the tips of the cutter teeth are so delicate. It is recommended that the hardness be held down to 25 or 30 Rockwell C as a maximum.

In preparing the gears for shaving it should be remembered that the quality of the finished gear depends to a large degree on the accuracy of the precutting. To give sufficient room in the root of the work tooth spaces for the shaving tool and for foreign matter which might be present, it is necessary to precut to extra depth. Our recommended depth from 20 D. P. to 120 D. P. is 2.4/D. P., plus 0.002 in.

### Inspecting Ultra-Fine Pitch Gears

By Louis Martin

THREE new classes of precision gears have been added to the list of gear classes being considered by the AGMA. These three new classes are segregated from the rest and are specified in millionths of an inch.

Since gear accuracy is closely

BORG AND BECK
"E"
TYPE
CLUTCH
• Husky—Heavy Duty • "Strap Drive"
• Friction-Free • Smooth Engagement
• Minimum Maintenance
Engineered by BORG & BECK
for that vital spot where power takes hold of the load
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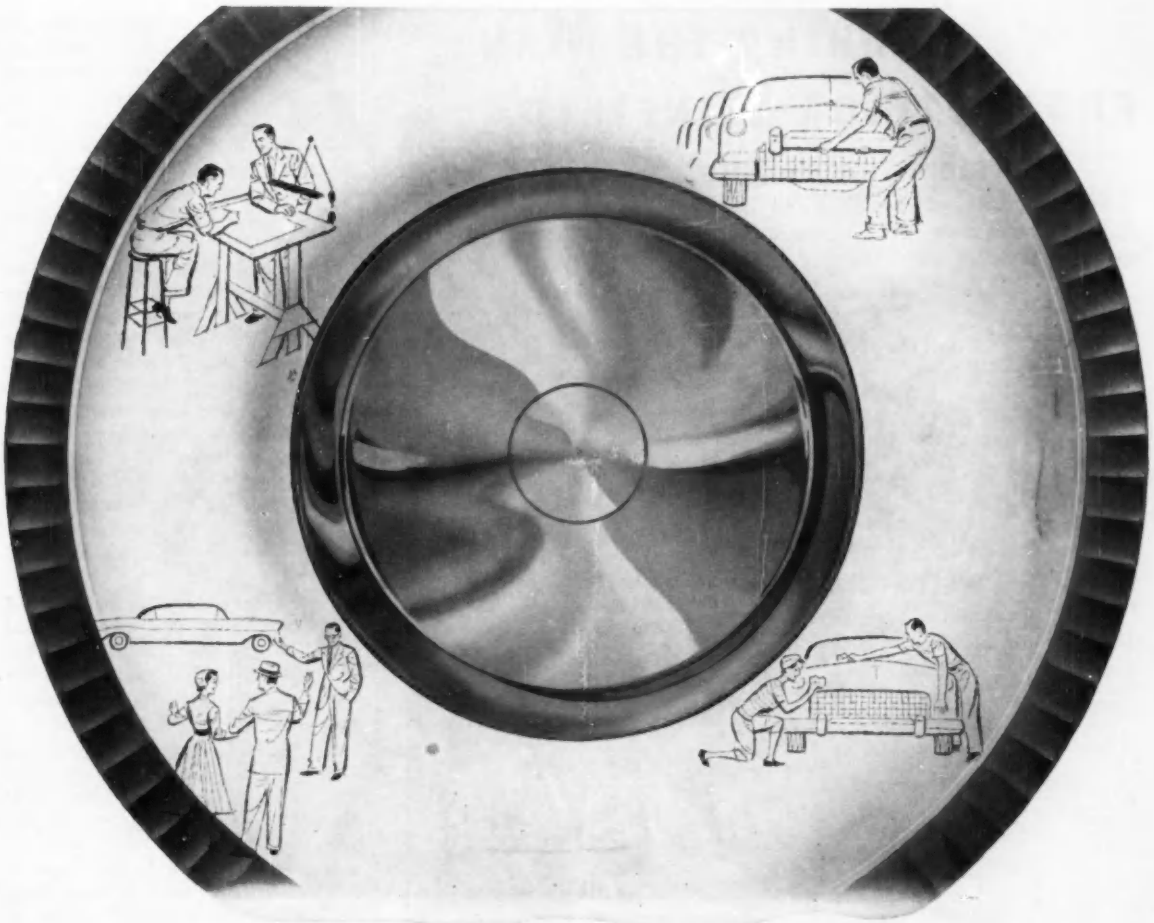

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# everybody goes for STAINLESS STEEL!

Stainless steel means many things to many people!

To you in the industry, its exceptional versatility means almost limitless freedom. With one metal, *designers and engineers* work with beauty (set off by a wide variety of finishes), fabricating ease, remarkable structural strength, and great resistance to all weather conditions.

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**And to everybody,** new and used car buyers alike, it's that series of parts that never age . . . never pit, flake or lose their sparkle. In the driveway, it makes a car a showpiece.

Why not let the Crucible engineer help you apply stainless steel profitably? *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

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T-W recommended practices for basic types of resistance welding on a wide range of metals.

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wedded to gear tooling accuracy, it is necessary to constantly check the tooling. Pressure angle tolerance of gears increase as the pitch become finer, in fact, it is almost in inverse proportion to the pitch. The reason is this: The hob manufacturer requires the same tolerance for a class "A" hob of 20 pitch as he does for a hob as fine as 0.200 pitch.

The profile of a 20 pitch hob can be checked to a much higher degree of accuracy, by means of a good indicating device than the finer pitch hobs which are checked on optical comparators. Of the three leading makers of optical comparators in this country, not a single one of them would go on record of guaranteeing an accuracy better than 0.0001 in., especially on a helical member like a hob. One of three makers would not guarantee anything beyond 0.0002 in.

Reflect that the inability to read the tolerance in this case is equal to the entire tolerance itself. Even if we accept only 0.0001 in. as the limit, it would constitute the major portion of the entire tolerance.

Two-hundred pitch 20 deg pressure angle, master gears were claimed by the maker to have 0.00025 in. total composite error. These were checked on one of the better known involute gear checkers. The bottom land of a 200 pitch gear made in accordance to the AGMA fine-pitch system is about 0.002 in. This means that the point of the tracing stylus had to be almost razor sharp. Its wedge angle had to be approximately 20 deg in order not to interfere with the opposite tooth profile.

Computations of the deflection at the point of the stylus with the applied load of the indicator showed that the point of tangency of the stylus was approximately 0.0025 in. outside of the base circle. Purely out of curiosity, this intriguing problem was tackled. The mechanical diameter indicator was eliminated and a tiny mirror was substituted on the moment arm which had a hair line scribed across-wise on its face. By means of a reflecting light system a tenth of a thousandth was magnified so that it looked like an inch. The thing that bothered us most was building vibration. The reflected line danced all over the scale. The obtainment of precise measurements of very fine pitch gears is a laborious, painstaking operation and cannot be done satisfactorily except under ideal conditions.

As near as could be determined the

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ROCHESTER PRODUCTS DIVISION OF
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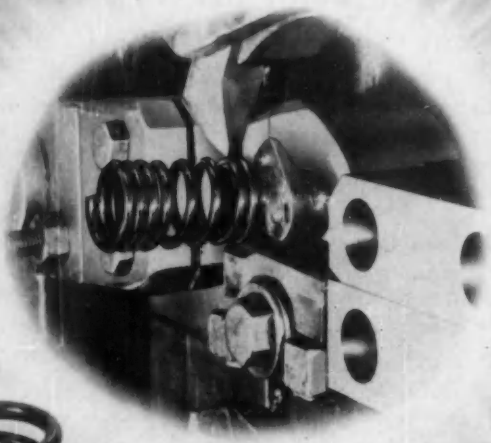
**ROCHESTER AUTOMOTIVE FUEL CONTROLS**

# PRECISION?
# DEPENDABILITY?
# it's Automatic!

**QUALITY-CONTROLLED SPRINGS FOR YOUR PRODUCT**



*Engine Valve Spring as coiled*

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**at Automatic is another outstanding example of the various precision operations that produce perfect springs for your product. Modern, high speed coilers in a complete range of sizes are arranged for continuous flow production. Every operator is equipped and trained to maintain uniformity and high quality.**

**During coiling alone, Automatic springs receive these seven quality-control tests.**

1. **Tests for proper surface condition**
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5. **Tests for active and inactive coils**
6. **Tests for pitch or "lead"**
7. **Tests for uniformity.**

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**Valuable booklet on how to specify and order springs. Send for it today**

*for quality springs "Automatically" think of*

**AUTOMATIC**

**SPRING COILING CO.**

**4048 West Thorndale Ave., Chicago 30, Ill.**


pressure angle of those otherwise very fine master gears was not 20 deg, but about 18 deg, 4 sec.

Master gear quality has been improved greatly in the past few years. The kind of masters required to check gears of 30 millionths composite error are off in the dim future. In spite of some shortcomings, the composite check still dominates the picture for the fine pitch gears used in aircraft. It should be supplemented by a rapid reliable, check of angular transmission.

Contrary to general belief, the small, ultra precision gearing used in aircraft components is highly competitive. Cost objectives are important. It isn't possible to subject these tiny gears to the same checking treatment that is used for larger, much more expensive gears, where, often, the checking of a single gear may require several days.

The use of theodilites and interferometry is impractical for this type of gearing. The answer must be found in simpler methods for setup checks to verify the accuracy of equipment. They should be supplemented by the composite check.

## Use of Aluminum in Automobile Trim

(*Continued from page* 49)

Automotive engineers have become increasingly interested in softer suspension for more comfortable riding. The trend is toward the use of air or hydraulic systems. These normally require pump units, and these, in turn, will probably be housed in aluminum castings to save body weight.

The emphasis on operating economy has sparked designers and engineers to consider new methods of reducing engine weight. A definite step in this direction is the die-cast aluminum engine block, jointly developed by Kaiser Aluminum and Doehler-Jarvis Div. of National Lead Co., which is currently undergoing evaluation by automotive manufacturers. Reynolds Metals claims that aluminum blocks will be used extensively by the automobile industry by 1960.


**AUTOMOTIVE INDUSTRIES . . .**

***Is your News Magazine of Automotive and Aviation***

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## High Production Draw Benches

Here's greater cold draw production at a substantially reduced cost! McKay's line of rugged, precision built equipment is designed to meet and exceed today's accelerated demands.

FOR EXAMPLE; Integral, centerline push pointing provides smooth flow and eliminates a costly operation. Die blocks and pusher blocks are retained in machined ways, eliminating bolts and facilitating change over. Carriage return speeds are stepped up, allowing more productive time in the draw cycle. Automated lines are possible merely by addition of standard units already proved and in operation.

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**Youngstown, Ohio**

**Pacific Coast Representative:**
**ENGEN INDUSTRIAL COMPANY**
**Los Angeles, California**

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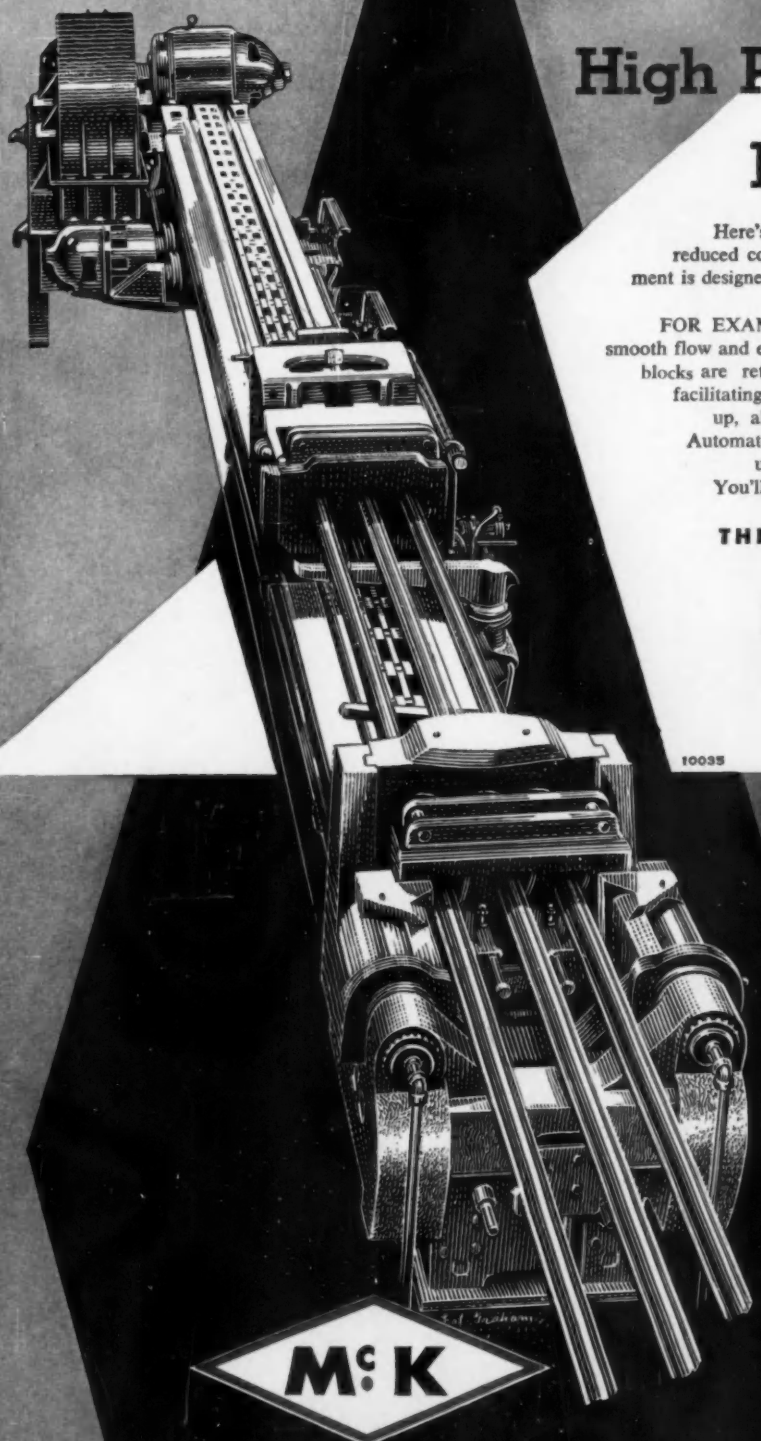

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*SCREWDRIVERS —*

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- Completely disengage the instant the fastener is run to desired tightness.
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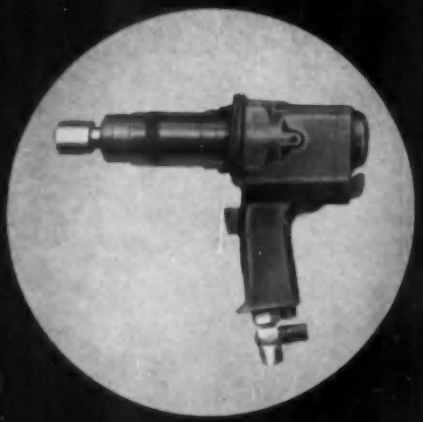

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Air-driven "Magnamatic" is the *only* Controlled-Torque screwdriver-nutrunner to prove itself in over two years of "on the line" service. In hundreds of applications, Magnamatic "One-Shot" Screwdrivers are used where proper tightness is all-important in eliminating stripped threads, sheared fasteners, damaged parts. Tell us your fastener problem. There are 13 models of "Magnamatic" to help you step up production and reduce fastening costs.

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# News of the MACHINERY INDUSTRIES

(*Continued from page* 79)

Development of the precise interferometric comparator represents an important step toward the goal of this program. Still remaining is the problem of developing to an accuracy of the nearest ten-millionth of an inch—of the primary standard gage blocks with which the Bureau compares industry's master gage blocks.

The manufacturing firms supporting the Bureau gage block research program are E. I. Du Pont de Nemours and Co., Greenfield Tap and Die Corp., Hughes Aircraft Co., The Taft-Peirce Manufacturing Co., The Timken Roller Bearing Co., The Van Keuron Co., The Sheffield Corp., The DoALL Co., Dearborn Gage Co., and Pratt and Whitney Co., Inc.

## Around the Industry

**Norton Co.** has acquired a controlling interest in Abrasivos Irmaos Meyer, S. A. of Sao Paulo, Brazil. This firm manufactures coated abrasives, grinding wheels, and abrasive grain. The announcement was made by A. Donald Kelso, vice-president in charge of Norton's foreign operations and president of Norton Behr-Manning Overseas, Inc.

**Bullard Co.** earned over $275,000 for the third quarter. Earnings for the first nine months totaled $1,103,030.

**The Warner & Swasey Co.** broke ground recently for the first of two additions to its New Philadelphia, Ohio, plant. The new building, to contain manufacturing and storage space totaling some 33,000 sq ft, is expected to be ready for occupancy in April, 1957.

**The R. K. LeBlond Machine Tool Co.** has announced the purchase of The Fosdick Machine Tool Co., Cincinnati, Ohio. Carl E. Linden, Foddick's general manager has been appointed president and general manager of the Fosdick firm.

**Pratt & Whitney Co., Inc.,** plans to spend millions of dollars for modernization. Current order backlog of the firm is $30 million.

**Detroit Broach & Machine Co.** is building a 15,000 sq ft addition to its plant in Rochester, Mich.

**Snyder Tool & Engineering Co.** has reported net earnings of more than $450,000 for the fiscal year ended June 30th. The net profit figure is about five per cent of net sales, which totaled about $9.5 million.

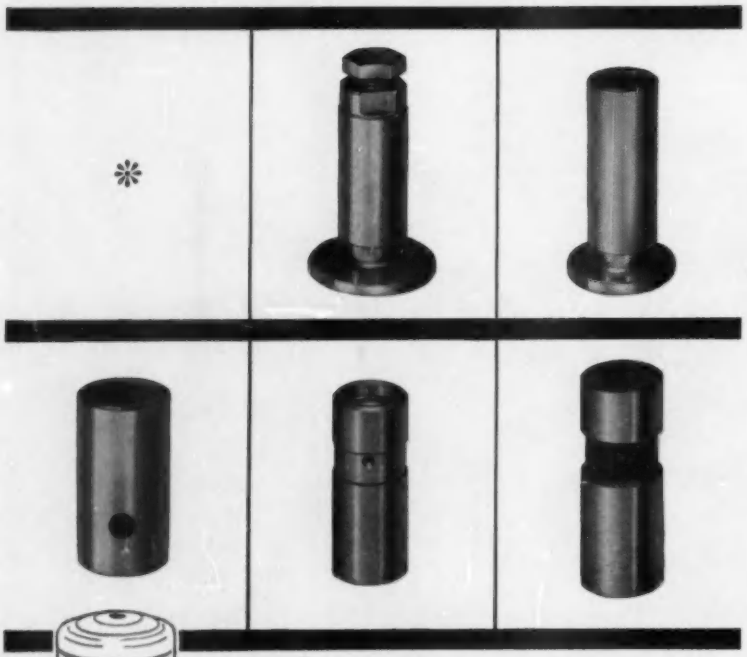
**The Sterling Foundry Co.,** subsidiary of The Warner & Swasey Co., has acquired in excess of 90 per cent of the outstanding shares of Brown Industries, Inc., a foundry in Sandusky, Ohio.

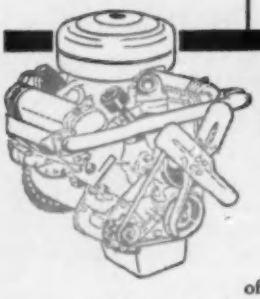
**Ex-Cell-O Corp.** reports high sales and earnings for the nine months ended Aug. 31. Sales, which included income from leased machines, totaled $106 million compared with $75 million a year earlier, while earnings rose by more than $2 million to $10.52 million from $8.09 million. The nine-month financial report included sales and earnings of Michigan Tool Co., acquired by Ex-Cell-O in March 1955.

**ASTE has given a $37,600 contract** to Battelle Memorial Institute for an evaluation of the present knowledge of metal cutting.

**E. W. Bliss Co.** directors have appointed James T. Harrington secretary of the firm. He will also continue in his former post as director of public relations.


JOHNSON *tappets*





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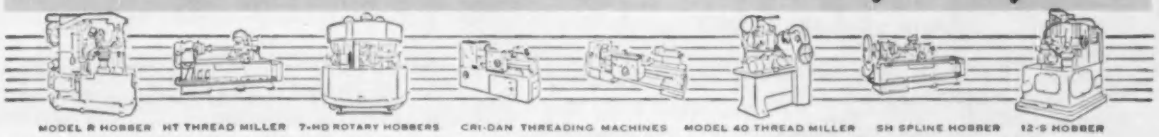

MODEL R HOBBER · HT THREAD MILLER · 7-HD ROTARY HOBBERS · CRI-DAN THREADING MACHINES · MODEL 40 THREAD MILLER · SH SPLINE HOBBER · 12-S HOBBER

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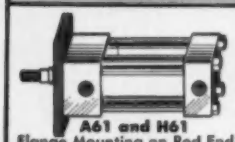
See Miller Bulletins A-105K(Air) and H-104K(Hydraulic) for Complete Dimensions and Engineering Data on these "in-stock" sizes and other Custom Miller Cylinders in bores up to 20" and strokes up to 22 feet.

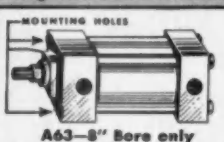
## "IN-STOCK" MODELS

"A" Signifies Miller 200 psi Air Cylinders; "H", 2000 psi Hydraulic Cylinders. Interchangeable Mountings Are Shown In Red On Drawings.



**A61 and H61** Flange Mounting on Rod End (A61 not available in 8" bore)

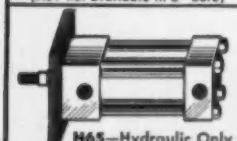
**A62 and H62** Flange Mounting on Cap End (A62 not available in 8" bore)




**A63—8" Bore only** Flange Mounting on Rod End

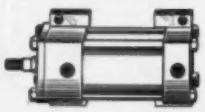
**A64—8" Bore only** Flange Mounting on Cap End

**A50 & H50**—Tie Rods not extended beyond nuts.
**A51 & H51**—Tie Rods extended both ends (shown).
**A52 & H52**—Tie Rods extended. Cap End only.
**A53 & H53**—Tie Rods Extended. Rod End only.
**A54 & H54**—Two Tie Rods extended at both ends.

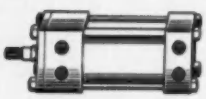


**H65**—Hydraulic Only Flange Mounting on Rod End

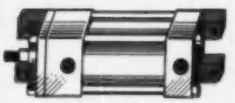
**H66**—Hydraulic Only Flange Mounting on Cap End



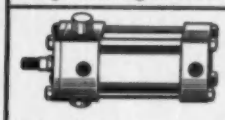
**A72 and H72** Side Lug Mounting



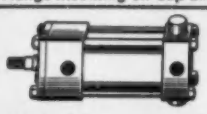
**A74 and H74** Side Flush Mounting



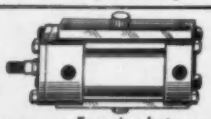
**A77 and H77** Side or Foot Mounting



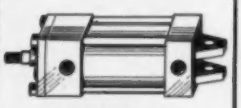
**A81 and H81** Trunnion Mounting on Rod End



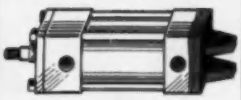
**A82 and H82** Trunnion Mounting on Cap End



**A83 and H83** Trunnion between Head and Cap (one week delivery)



**A84 and H84** Pivot Mounting



**A86 and H86** Pivot Mounting

## IN STOCK BORES in Inches

| | BORES | ROD DIA. | ROD TURN DOWN & THREADS | "IN-STOCK" STROKES (in Inches) | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AIR | 1½ | ⅝" | 7/16-20 | Cushioned | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | | | | | | | |
| | | | | Non-Cush. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | | | | | | | |
| | 2 | ⅝" | 7/16-20 | Cushioned | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | | | | Non-Cush. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | 2½ | ⅝" | 7/16-20 | Cushioned | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | | | | Non-Cush. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | 3¼ | 1" | ¾-16 | Cushioned | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | | | | Non-Cush. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | 4 | 1" | ¾-16 | Cushioned | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | | | | Non-Cush. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | 5 | 1" | ¾-16 | Cushioned | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | | | | Non-Cush. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | 6 | 1⅜" | 1-14 | Cushioned | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | | | | Non-Cush. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | 8 | 1⅜" | 1-14 | Cushioned | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | | | | Non-Cush. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| HYDRAULIC | 1½ | ⅝" | 7/16-20 | Cushioned | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | | | | | | | |
| | | | | Non-Cush. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | | | | | | | |
| | 2 | 1" | ¾-16 | Cushioned | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | | | | Non-Cush. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | 2½ | 1" | ¾-16 | Cushioned | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | | | | Non-Cush. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | 3¼ | 1⅜" | 1-14 | Cushioned | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | | | | Non-Cush. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | 4 | 1¾" | 1¼-12 | Cushioned | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | | | | Non-Cush. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | 5 | 2" | 1½-12 | Cushioned | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |
| | | | | Non-Cush. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 28 | 32 | 36 |

(1) (2) (3) (4)

"A" and "H" Models 82, 84 and 86 with strokes over 18" require stop tubes.

Column strength requires larger diameter piston rods for the following:

Air Cylinder Models A82, 84, and 86 with strokes inside area (1), when operated at 100 psi and over;

All hydraulic models with strokes inside area (2) and Models H82, 84, and 86 with strokes in area (4), when operated at 2000 psi and over;

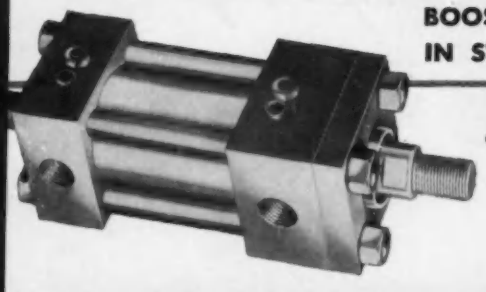
Models H82, 84 and 86 with strokes inside area (3), when operated at 1000 psi and over.

Depending upon Trunnion Pin location, "A" and "H" Models 83 with standard diameter piston rods can have longer strokes than Models 82, 84 and 86.

See Miller File #251 for oversize piston rod and stop tube requirements.

## BOOSTERS IN STOCK

Immediate Delivery on the following Miller 25 to 1 Ratio Boosters (80 psi air input produces 2000 psi hydraulic oil output): Model B4, 5" bore, 1" dia. ram, 6" and 12" strokes; Reciprocating Booster Model DA77-RBA8, 5" bore, 1" dia. ram, 6" stroke. Also Booster Tanks, 5" dia., 6" and 10" heights.



*Write For Catalog and Stock Price List*

Miller

**MILLER FLUID POWER DIVISION** FLICK-REEDY CORP.

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AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

# NEW PRODUCTS

(*Continued from page* 93)

## Four-Headlight Lamps

Two headlamps have been announced to meet the requirements of the four-lamp headlighting systems which some manufacturers are installing for the first time on 1957 model cars. Under the new system, drivers will use four lamps for regular driving, two lamps when passing. The new lamps will be known as Driving Lamp No. 4001 and Passing Lamp No. 4002. The 4001 lamps will be single filament inboard lamps and will provide the hot spot of the driving beam. The 4002 lamps will have double filaments and will provide the spread light of the driving beam from an off-axis filament, and a new passing beam from the on-axis filament.

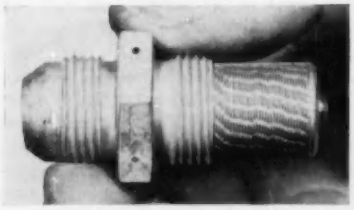
Increased wattage will provide more light for both driving and passing, while design improvements will provide greater seeing distance when passing. Both lamps will be fitted with three aimer buttons on the lens to provide simple mechanical aiming. Locating lugs on the back of the lamps will insure that only the correct lamp can be installed in the new type headlight fixtures.

Both high and low beams have "fog caps" which provide improved visibility in rain, fog, snow, dust, or inclement weather in general. It is reported the shielding of the high beam serves its function without reduction of light for seeing while driving through the country. *Lamp Div., Westinghouse Electric Corp.*

Circle 69 on postcard for more data

## Union-Filter

For protecting aircraft hydraulic system valves and other precision components, a two-way union-filter has been developed which consists of



two frameless wire-wound filter elements welded to a union. It can handle the flow of hydraulic fluid in either direction. The elements of the filter are nested to provide more filtering area and less pressure loss than would apply with a single element. It is said the filter will catch particles down to 0.003-in. in size.

The unions can be made in all AN sizes for standard aircraft practice and are available in aluminum, stainless, or plated steel. *Purolator Products, Inc.*

Circle 70 on postcard for more data

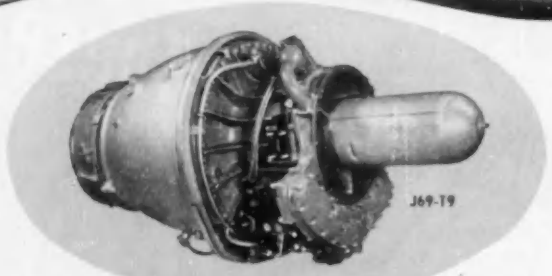
## High Density Alloy

Developed for use in gyroscope rotors, a new high strength, high density alloy called 1000 Gyromet is said to have higher stability and strength than previously obtainable. These properties reportedly enable the material to withstand rotor speeds about 25 per cent higher than permissible with other materials, making it possible to design rotors to higher speeds, smaller size. Its greater stability indicates use in such applications as inertial guidance systems, where exceptional precision and uniformity are required.

The material has a density of 16.70 to 17.05 gm/cc. Its proportional elastic limit is 62,000 psi; modulus of

Burr-Blast Parts Like These...
at rates up to 288 per hour
Five Burr-Blast models available — manually loaded stationary or continuous rotating units and fully automatic in-line types—permit you to pick the right type and size machine to remove fragmentary burrs from finish machined nonferrous or cast iron parts. Simple installation uses normal plant air supply from 60 to 80 psi. Built-in flexibility permits burring a variety of parts on any of the Burr-Blast models.
You also benefit from Modern's experience in successfully blast burring a wide range of part shapes and sizes with every known blasting material including: walnut shells, silicon carbide, steel shot, etc.
Ask for literature describing Modern's Burr-Blast line.
MODERN®
Industrial Engineering Co.
14230 BIRKWOOD AVE.
DETROIT 38, MICHIGAN

# TEMCO TT-1




## LATEST DEFENSE ASSIGNMENT for CAE TURBINE POWER

**Performance and ease of control join hands with a high degree of safety in Temco's TT-1 primary jet trainer, which the Navy has ordered into production after exhaustive tests. This modern tandem two-seater is designed to condition the student's reflexes to the piloting of jets, from the very start. It is a matter of pride and gratification to CAE that this newest addition to our country's military training equipment flies with Continental J69-T-9 gas turbine power.**

CONTINENTAL AVIATION & ENGINEERING CORPORATION
12700 KERCHEVAL AVENUE, DETROIT 15, MICHIGAN

SUBSIDIARY OF CONTINENTAL MOTORS CORPORATION


elasticity in tension is 44 by $10^6$ psi. Endurance limit is 55,000 psi. Like its companion Mallory 1000 Metal, 1000 Gyromet is a sintered alloy of tungsten, nickel, copper and other elements. Said to be readily machined, it is available in varied stock forms and sizes. *P. R. Mallory & Co., Inc.*

Circle 71 on postcard for more data

### Non-Sticking Rubber

Announcement has been made of a new rubber compound which is said to have outstanding non-sticking properties, making it ideal for valve seat and other applications requiring this characteristic. Known as Compound No. 1318, the material gives quick break-away without lubrication. Recommended temperature range is —40 F to 300 F. It also has excellent bonding-to-metal properties, the company reports. *Goshen Rubber Co., Inc.*

Circle 72 on postcard for more data

### Improved Headlamps

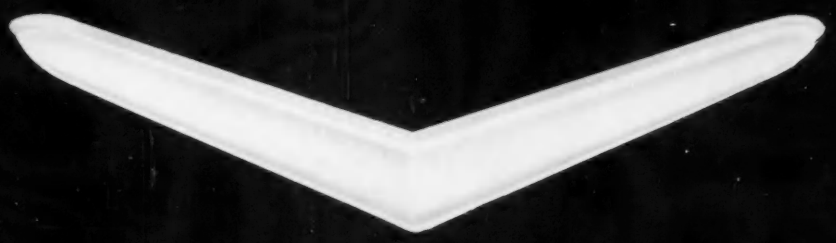
Designed for use in four-lamp headlight systems, two sealed beam headlamps just introduced are said to give motorists easier, better and safer seeing for nighttime driving by providing more light in both beams, better controlled light on both upper and lower beams, and more effective lighting in rain, snow, fog and dust.

The main part of the upper beam is supplied by a pair of lamps of one type, each having a single 37½-w filament. The other type lamp has two filaments, one rated at 50-w and another at 37½-w. The lower-rated filament provides part of the upper beam, being unshielded so that the light is directed above and to the sides of the main beam. The 50-w filament provides, with its mate on the other side, the lower or passing beam. A small metallic hood above this low-beam filament keeps stray light from shining upward into fog. When driving on the upper beam, all four headlamps are used; on the lower beam, only the two 50-w filaments are lighted.

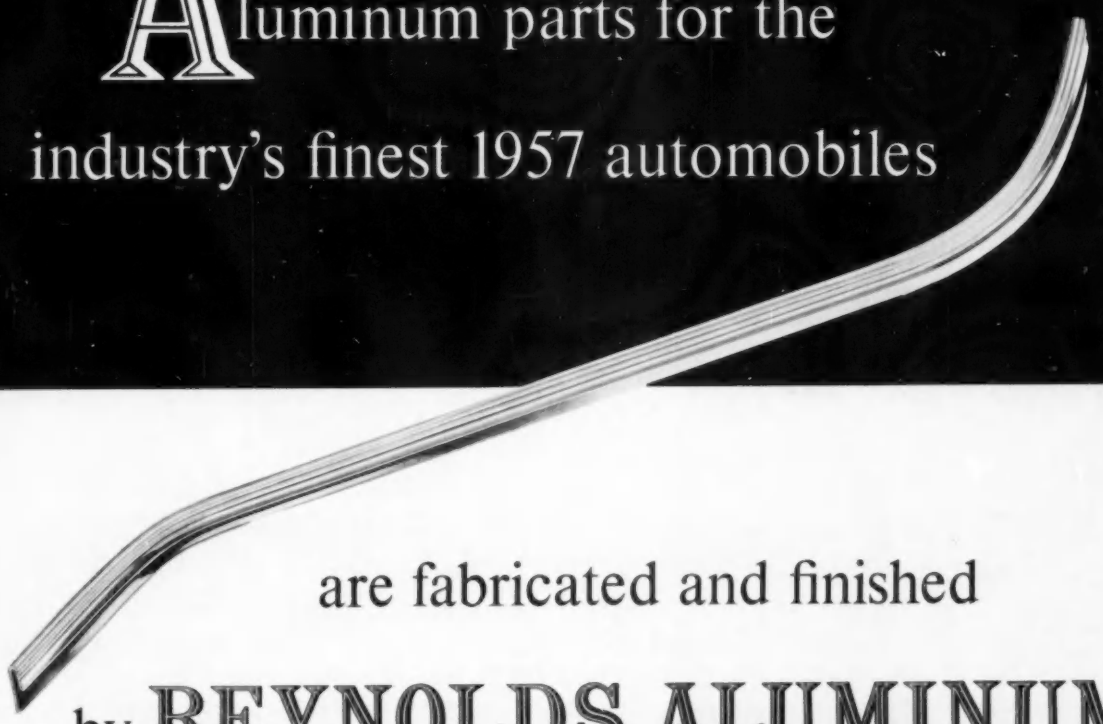
The new lamps are 5¾-in. diam, 1¼-in. less than conventional lamps. They have different bases and are not interchangeable. When mounted vertically, the lamps with the two filaments will be on the top. If mounted horizontally, the two-filament lamps are on the outer edges.

The new headlamps also have "Aim-right Gizmoes" to facilitate aiming with mechanical aimers. *Miniature Lamp Dept., General Electric Co.*

Circle 73 on postcard for more data



# Aluminum parts for the industry's finest 1957 automobiles



are fabricated and finished

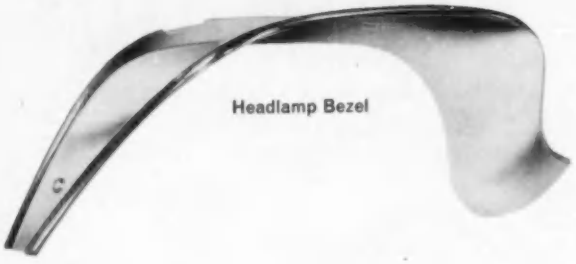
by **REYNOLDS ALUMINUM**
FABRICATING SERVICE

**here's why...**

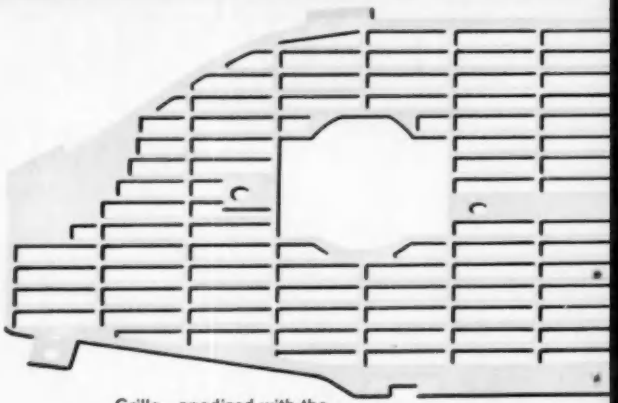
There's added sales appeal, quality and economy in clear and color anodized aluminum parts and trim like these, fabricated and finished by

## REYNOLDS ALUMINUM FABRICATING SERVICE

Side Panel Trim Strip
blanked and clear anodized by Reynolds
(additional fabricating done by another automotive supplier)

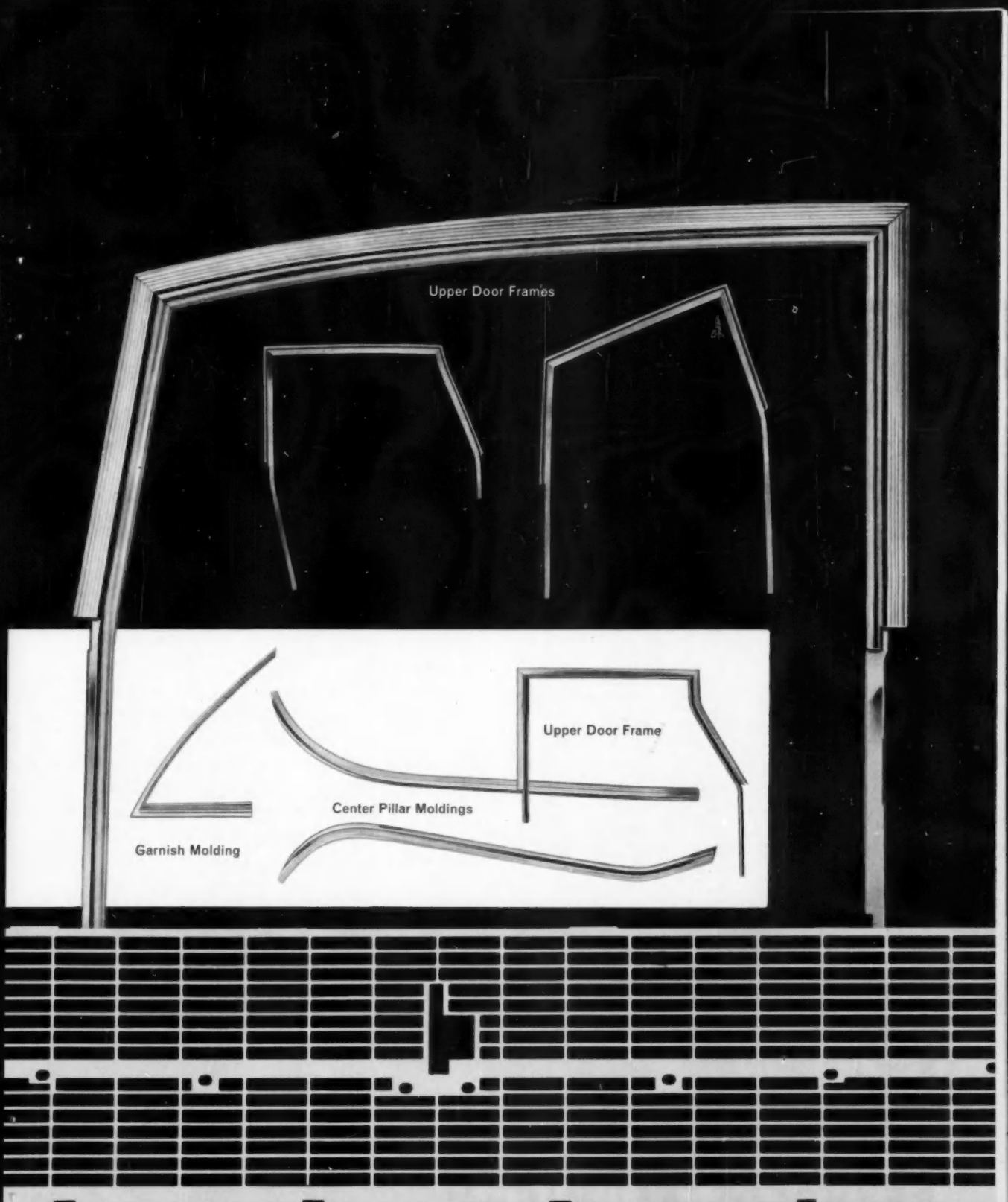


Headlamp Bezel



Grille—anodized with the
"gleam of gold" or the "look of sterling"

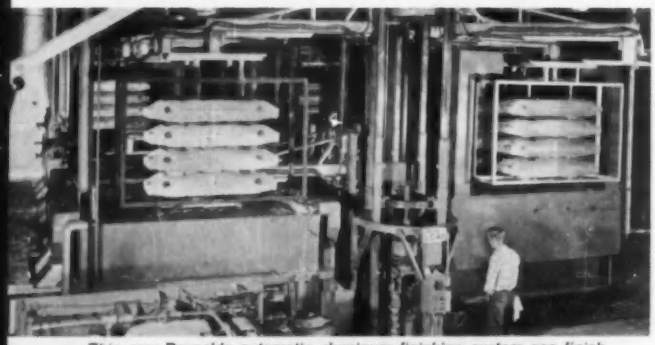
Hood Molding



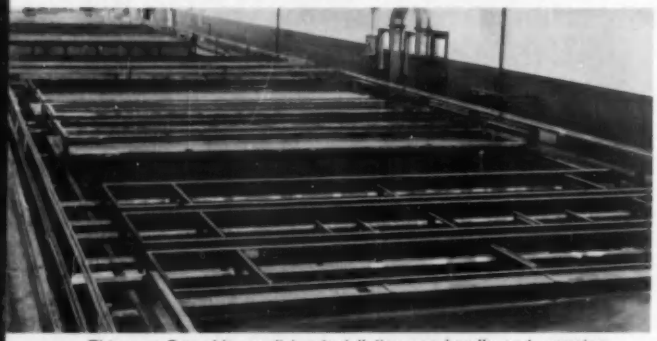

Here are some of the facilities Reynolds offers for production of aluminum automobile parts and trim...

# At your service...

## vast Reynolds fabricating and finishing facilities



This new Reynolds automatic aluminum finishing system can finish mixed sizes and types of automobile parts and chemically brighten or anodize them in different colors—and can handle several different jobs at the same time. An automatic coding system establishes the individual finishing specifications for each job.



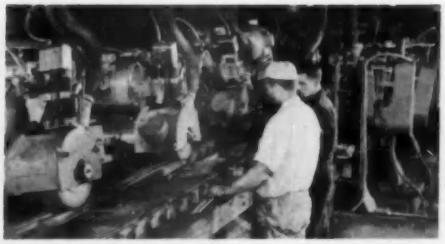
This new Reynolds anodizing installation can handle parts ranging from small automobile trim parts up to parts 24' long, 12' high and 4' wide. This half-block long system is another new addition to Reynolds multi-million dollar finishing facilities investment.

From start to "finish" on automobile parts and trim, Reynolds has more to offer. For example: Vast fabricating facilities with over 200 pieces of major production equipment in two plants alone plus finishing facilities unsurpassed anywhere. Quality control from mine to the finished part. Experienced design and engineering service.

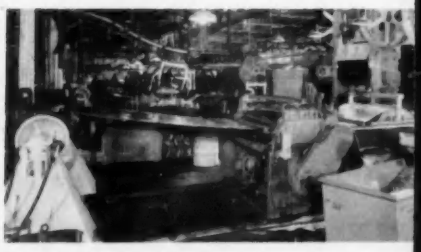
These Reynolds strong points add up to greater sales appeal, quality and economy for automobile manufacturers. Sales appeal with gleaming *clear* or *color anodized* and mechanical, chemical and painted finishes. Quality stemming from quality control plus technological know-how in producing and fabricating aluminum. Economy because of the tremendous variety of most modern automatic fabricating and finishing equipment.

For full details on Reynolds fabricating and finishing facilities, contact your nearest Reynolds Branch Office or write *Reynolds Aluminum Fabricating Service, 2004 South Ninth Street, Louisville 1, Kentucky.*

Reynolds can paint entire parts a solid color, mask and paint or do paint filling in combination with mechanical finishing to supply most desired textures or highlighting effects.



Part of a battery of Reynolds new high speed buffing equipment used here on 1957 hood moldings.



Part of a battery of high speed coil fed presses at Reynolds producing at the high rate necessary to meet automotive industry requirements.

# REYNOLDS ALUMINUM FABRICATING SERVICE

**BLANKING • EMBOSSING • STAMPING • DRAWING • RIVETING • FORMING**
**ROLL SHAPING • TUBE BENDING • WELDING • BRAZING • FINISHING**

The Finest Products Made with Aluminum are made with REYNOLDS ALUMINUM

## Hydraulics Conference

(*Continued from page* 102)

grown tremendously, and one manufacturer has indicated that the maximum size is not yet in sight. This growth may take the vehicles out of the class for which integral power steering is practicable. The semi-integral unit is ideal here.

Two-wheel tractor units used with scrapers are steered by various methods; for what is referred to as articulation steering, the semi-integral system is being used. Where a mechanical steering gear and follow-up linkage connected to the scraper steering mechanism are used, the control valve is operated through a lever on the lower end of the steering gear. In the mining industry, shuttle cars have used both booster steering units and integral power steering gears.

Applications of the torque converter in present-day equipment were discussed by R. M. Tuck, of Allison Div., General Motors Corp. These devices are used in the transit coach, off-highway trucks and scrapers, crawler tractors, shovels, oil field rigs, shovel loaders, rollers, motor graders, fork lift trucks, and locomotives. To meet the needs of such a wide range of applications the converter must supply relatively constant horsepower over a wide range of loads; and must permit full power operation for extended periods.

In addition, the blading system used must be flexible enough to meet the needs of various application with a minimum number of sizes.

In some applications high starting torque and maximum horsepower in the lower speed range may be required; in others, low starting torque but maximum power in the high speed range. The converter must be matched to the engine. To do this, both absorption capacity and performance characteristics must be varied within a given size converter.

Absorption capacity can be related to a propeller on a boat or plane. By varying diameter and pitch, capacity of the propeller can be varied, and similarly the capacity of a converter can be varied by changing the length and discharge angle of the pump.

The turbine, attached to the output shaft, and the stators, attached through one-way clutches to ground, are designed to convert the hydraulic energy back into shaft power. Turbine and stator exit angles as high as possible, consistent with adequate flow area, are used. Each entrance angle is set to provide the best compromise with the various angles of entry of fluid into the element.

Three principles in converter design are: (1) that the junction having the greatest range in angle of oil flow is at the stator entrance; (2) that the wide range of angles at the stator entrance can be controlled by using two stators, the first rotating at a speed between that of the oil leaving the turbine and that entering the second stator, thus making the change in two steps; and (3) that performance may be altered through adjustment of these entrance angles to provide maximum starting torque and low speed performance, or maximum efficiency at higher output speeds.

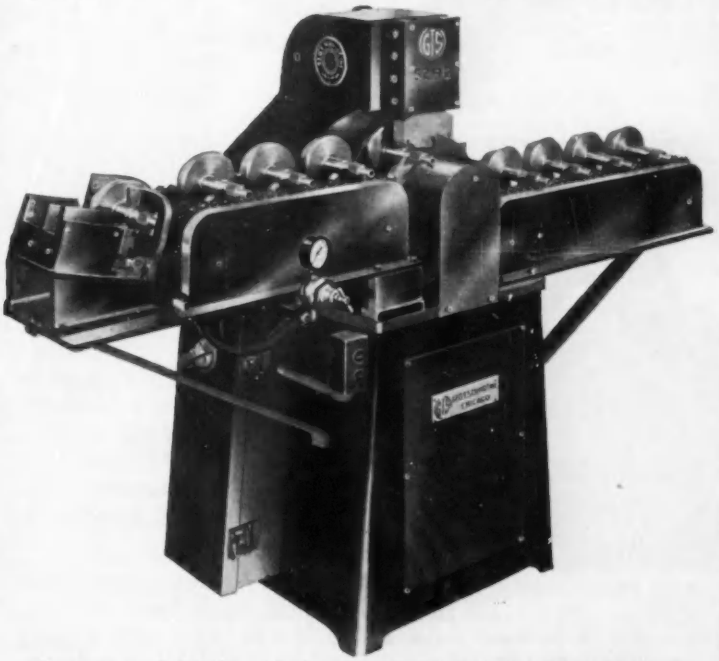
Usable performance range at high operating efficiency has gradually improved as a result of advanced methods of solution, both in computation and in laboratory testing. All projects start with an analysis of the problem; then proposed improvements are worked out using the interrelated formulas of power heads and loss heads. Use of the digital computer has greatly lessened the time required.


**PINION GEAR MARKING?**

GTS Model 395

This fully automatic GTS unit marks code numbers on pinion gears—uniformly and accurately—at a production rate of 900 per hour.

DOES IT *ECONOMICALLY . . . AUTOMATICALLY*



The gears are fed to the spider by means of a chain feed, which carries them under a concave lettering tool. A pneumatic cushion is provided in the die holder to accommodate variations in diameter, insuring uniform depth of marking within both high and low tolerance limits.

**FOR FURTHER INFORMATION** about this model, or for expert engineering assistance with any industrial marking problem, see your nearest GTS representative, or write direct.

*IF IT'S WORTH MAKING, IT'S WORTH MARKING.*

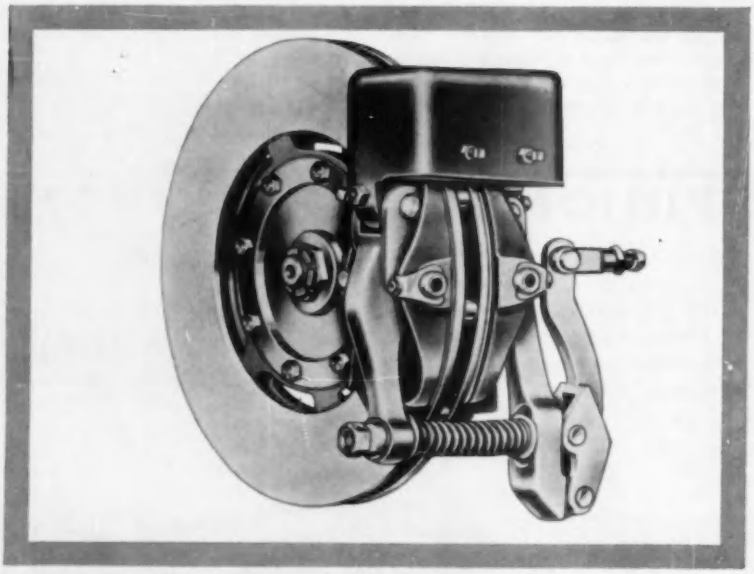
**GEO. T. SCHMIDT, INC.**
4110 Ravenswood Avenue Chicago 13, Illinois

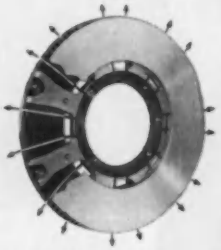
an ACCO product

It pays to specify

# Tru-Stop Brakes

ENGINEERED TO SERVE YOU BETTER—3 WAYS!





**This is The Difference**

One look at a TRU-STOP Brake is enough to know that it will cool itself faster than any other known type of brake.

1. Most of the disc is exposed to the air even during the braking operation.

2. The ventilated design supplies cooling air which circulates between the disc plates.

**1. EMERGENCY** • TRU-STOP BRAKES operate on the propeller shaft. They serve as a complete and independent braking system. They enable the driver to continue on *SAFELY*, in event of service brake failure.

**2. PARKING** • Interstate Commerce Commission reports consistently show that the majority of parking brake accidents are due to insufficient braking capacity. Such accidents can not happen to a vehicle equipped with TRU-STOP Brakes.

**3. AUXILIARY** • Most drivers occasionally use the hand brake to help the service brake. TRU-STOP Brakes have the surplus braking capacity to be used in this way—repeatedly.

*Specify TRU-STOPS for factory installation on the next vehicle you buy. Send for your copy of this booklet.*

ACCO

Automotive and Aircraft Division
AMERICAN CHAIN & CABLE

601 Stephenson Bldg., Detroit 2
2216 South Garfield Ave., Los Angeles 22 • Bridgeport 2, Conn.

## Cadillac's Eldorado

(*Continued from page 53*)

the weight of the car, compensate for uneven road surfaces without noticeably affecting the normal position of the body and maintain the standing height—road to roof top—regardless of car loading.

Because of the constant height characteristics and variable rate characteristics, it is possible to soften the spring rate, giving a better ride.

The major components of both front and rear assemblies are the dome, rubber diaphragm, retaining plate and piston. The piston and rubber diaphragm fit into the dome, which is secured to the frame. It is the air in the dome, acting on the rubber diaphragm which serves as the spring between the two.

● THREE LEVELING VALVES (one at each rear air spring and one for the front springs which serves both means of a check valve) are the "brains" of the system. They control the car height by controlling the flow of air to each individual spring.

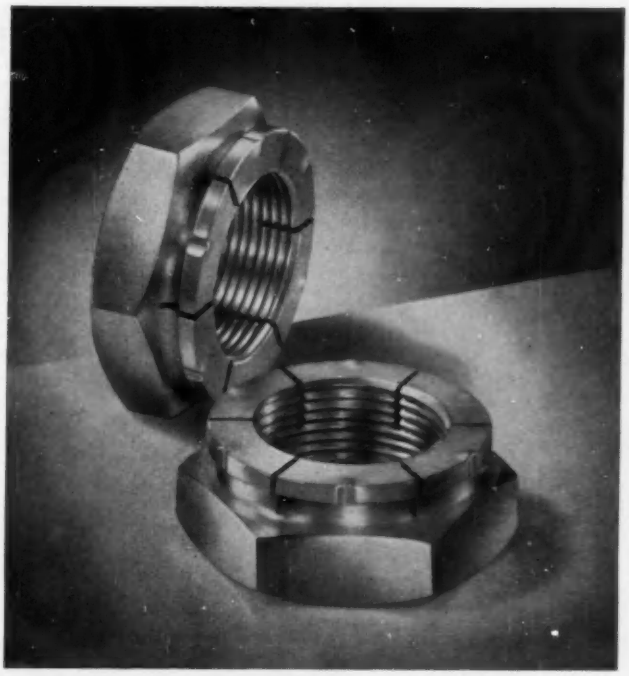
The valve is mechanically actuated by a rod which reacts to the up-and-down position of the frame and wheel supports. These positions result from differences in passenger and baggage loading, and are not affected by road irregularities.

● CONTROL SOLENOID consists of two pairs of valves. One pair of valves is known as the "lockout solenoid." Its function is to act as a lockout to the air lines for parking, wheel changing, or for preventing the operation of the leveling system for any reason. The other pair of valves act as a "restriction solenoid." Its function is to give fast or slow leveling by controlling the air flow to and from the air springs. For example, rapid leveling is desired when loading of the car is being changed. On the other hand, restricted leveling is desired when the car is in motion for a smooth ride.

● AIR COMPRESSOR AND ACCUMULATOR: The compressor, powered by an integral electric motor, provides the air for the system. A pressure limit switch starts and stops the compressor to maintain air pressure of 100 to 120 psi in the accumulator or air storage reservoir. The compressor is mounted on top of the generator; the accumulator is located just forward of the radiator on the radiator support.

These basic air suspension components along with the obvious air lines combine to give Cadillac's new Eldorado Brougham the smoothest and most constantly level ride ever known to a passenger car.

# Flexloc thin nuts save space, weight and production time



## Self-locking nuts are 30% lower and lighter; speed up assembly with hand or power tools

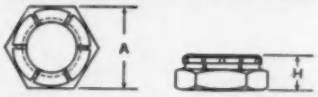
Self-locking FLEXLOC thin nuts are 30% lower than regular height locknuts of the same nominal diameter. They fit into spaces where regular height locknuts will not go. You can design lighter, more compact units with them.

Where you must reduce weight in a completed assembly, you can save by using shorter bolts with these lighter nuts. And you save production time. The length of engagement of mating threads is shorter: fewer revolutions of hand wrenches or power nut runners are needed to seat them.

FLEXLOC nuts are of 1-piece, all-metal construction. You can use a FLEXLOC fully seated as a locknut or at any point along a bolt as a stop nut. Once the threads in the resilient locking section are fully engaged, the FLEXLOC grips the mating threads with uniform locking torque wherever wrenching stops. Since there are no nonmetallic inserts to come out or deteriorate, the locking life of a FLEXLOC is virtually unlimited.

Your authorized industrial distributor stocks FLEXLOC nuts in a variety of sizes, materials and finishes. Consult him for details. Or write us for information about your special locknut problem. Flexloc Locknut Division, STANDARD PRESSED STEEL Co., Jenkintown 53, Pa.

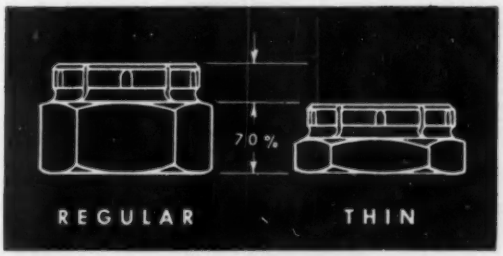
SPECIFICATIONS
FLEXLOC THIN NUTS




**NATIONAL COARSE THREAD—U.S.S**

| SIZE | A INCHES | H INCHES | WIDTH ACROSS CORNERS | WEIGHT PER 1000 NUTS |
|---|---|---|---|---|
| 6-32 | .312 | .125 | .361 | 1.8 |
| 8-32 | .344 | .172 | .397 | 2.8 |
| 10-24 | .375 | .172 | .433 | 3.3 |
| ¼-20 | .438 | .203 | .505 | 5.4 |
| 5/16-18 | .563 | .250 | .649 | 11.6 |
| 3/8-16 | .625 | .265 | .722 | 14.9 |
| 7/16-14 | .750 | .312 | .866 | 24.9 |
| ½-13 | .813 | .312 | .938 | 28.4 |
| 9/16-12 | .875 | .359 | 1.010 | 36.1 |
| 5/8-11 | 1.000 | .391 | 1.155 | 54.1 |
| ¾-10 | 1.125 | .406 | 1.299 | 69.2 |
| 7/8-9 | 1.312 | .469 | 1.516 | 107.5 |
| 1-8 | 1.500 | .563 | 1.732 | 171.6 |
| **NATIONAL FINE THREAD—S.A.E.** | | | | |
| 6-40 | .312 | .125 | .361 | 1.8 |
| 8-36 | .344 | .172 | .397 | 2.8 |
| 10-32 | .375 | .172 | .433 | 3.3 |
| ¼-28 | .438 | .203 | .505 | 5.4 |
| 5/16-24 | .500 | .250 | .577 | 8.7 |
| 3/8-24 | .563 | .266 | .649 | 11.5 |
| 7/16-20 | .625 | .312 | .722 | 14.9 |
| ½-20 | .750 | .312 | .866 | 21.7 |
| 9/16-18 | .875 | .359 | 1.010 | 36.2 |
| 5/8-18 | .938 | .391 | 1.082 | 42.4 |
| ¾-16 | 1.063 | .406 | 1.227 | 54.5 |
| 7/8-14 | 1.250 | .469 | 1.443 | 84.6 |
| 1-14 | 1.438 | .563 | 1.660 | 136.3 |
| 1 1/16-12* | 1.625 | .625 | 1.876 | 193.5 |
| 1 1/16-12* | 1.813 | .750 | 2.093 | 296.0 |
| 1 3/16-12* | 2.000 | .812 | 2.309 | 389.0 |
| 1 1/2-12* | 2.187 | .875 | 2.526 | 498.0 |

*Steel only (plain or cadmium plated) in stock sizes.




**FLEXLOC thin nuts are 30% lower** than regular height locknuts. There is a corresponding saving in weight. In sizes through 5/16 in., thin FLEXLOCS meet tensile strength requirements for regular height locknuts. FLEXLOC nuts can be made in the thin type because every thread, even those in the locking section, carries its full share of the load. There are no nonmetallic inserts to waste head space or weaken the structure of the nut.

**Standard FLEXLOC self-locking thin nuts are available** in plain or cadmium plated alloy steel, for use in temperatures to 550°F; in plain or silver plated corrosion resisting steel, for temperatures to 750°F; and in brass and aluminum, for temperatures to 250°F.

STANDARD PRESSED STEEL CO.
FLEXLOC® LOCKNUT DIVISION SPS
JENKINTOWN ■ PENNSYLVANIA

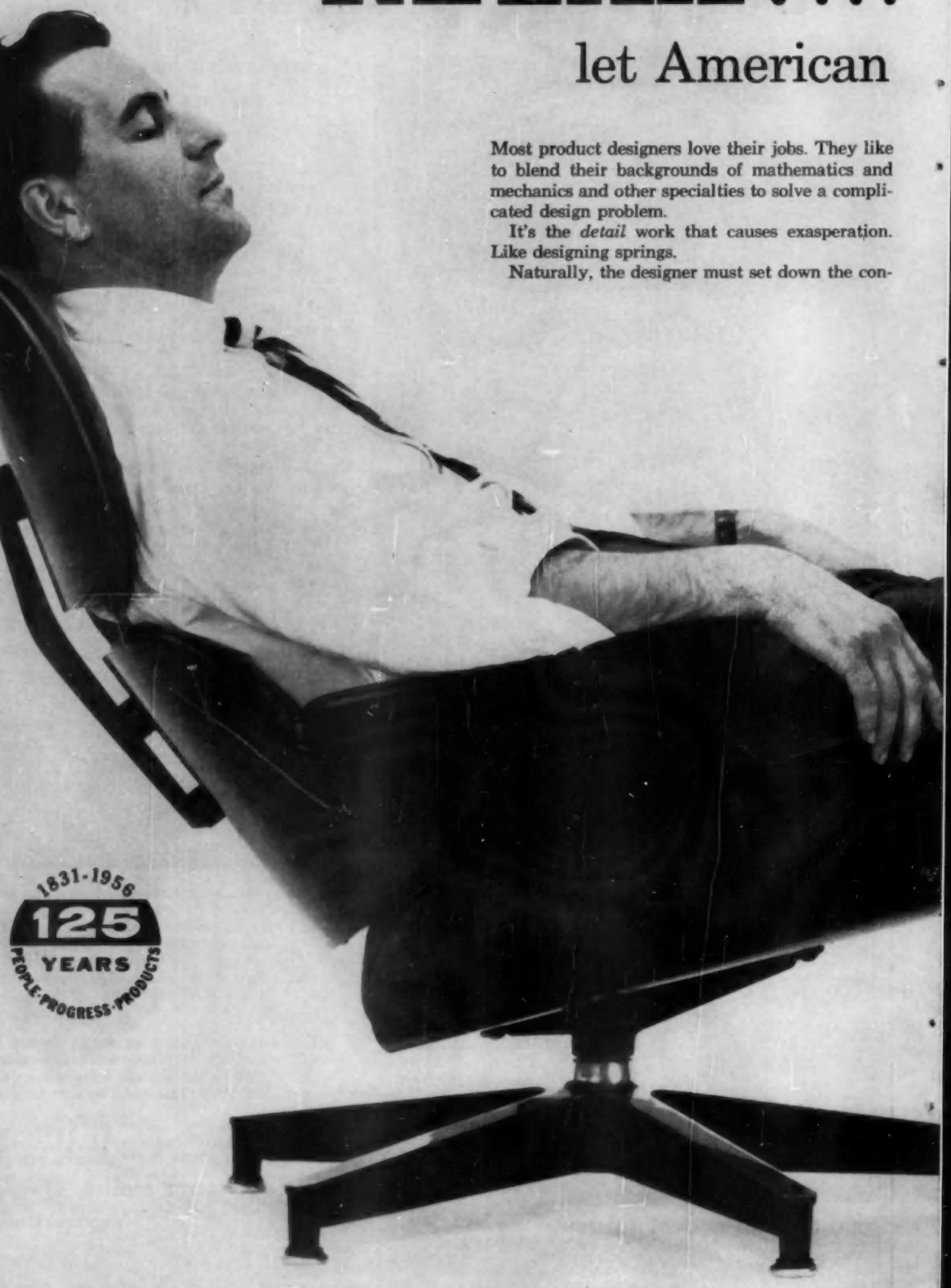
# RELAX!...

## let American

Most product designers love their jobs. They like to blend their backgrounds of mathematics and mechanics and other specialties to solve a complicated design problem.

It's the *detail* work that causes exasperation. Like designing springs.

Naturally, the designer must set down the con-



1831-1956
125
YEARS
PEOPLE · PROGRESS · PRODUCTS

# when you have a spring problem Steel & Wire worry *for* you

ditions of use. He knows how much stiffness he wants, what fastening system is desirable, the limits of spring travel, corrosion conditions and the like. Now, the plot thickens. Can such a spring be produced, in quantity, at a reasonable price?

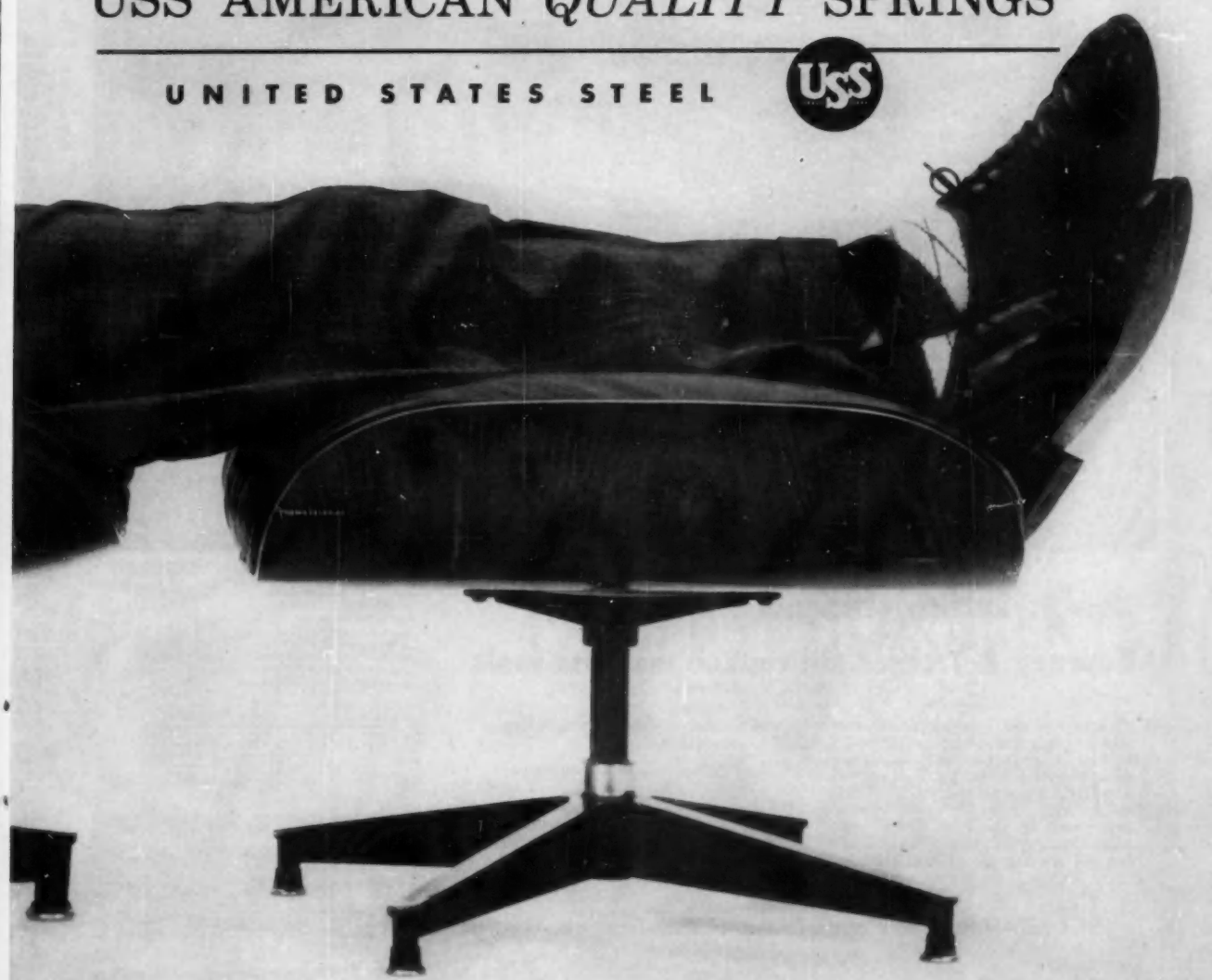
It is a rare designer who has concerned himself with these practical spring production problems. For this reason, American Steel & Wire maintains a staff of *spring engineers* to relieve you of this detail. They may be able to suggest a minor design change, or a different grade of steel, or a different finish that will give you a better spring than you contemplated at a decided savings in cost.

Just call your AS&W salesman.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS · TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

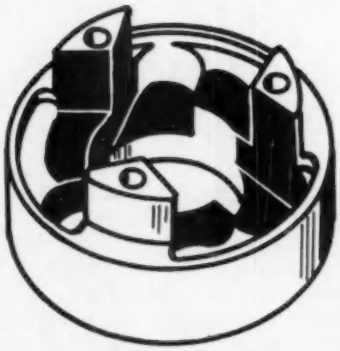
## USS AMERICAN *QUALITY* SPRINGS

UNITED STATES STEEL



# CUSTOMER SPECIFIED

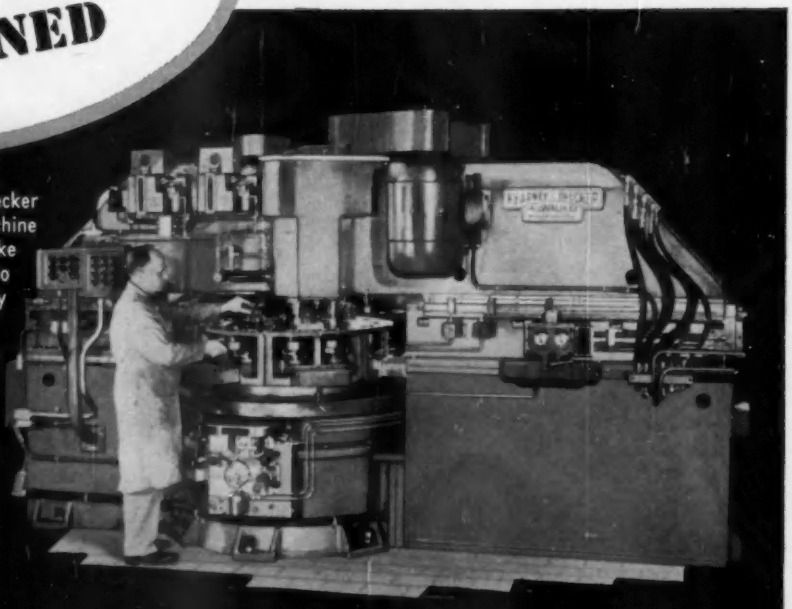
**An automotive manufacturer recently asked Kearney & Trecker to design and build a special machine which would increase production milling of three pads and three pockets on transmission rear brake drums.**



Black indicates machined pads and pockets on transmission brake drum.

# KEARNEY & TRECKER DESIGNED

Here is our design. It's a Kearney & Trecker six-station rotary indexing milling machine which mills 162 transmission rear brake drums per hour. It does the work of two machines, each of which could mill only one workpiece at one time. With the new unit, six pieces are milled at once. A prominent feature of this machine was the application of standard Kearney & Trecker units . . . a 48" rotary index table and a 24" feed slide. This type of design appreciably decreases the overall cost of the machine. All six spindles are contained in one head which is bridged over the table. Retractable quills raise and lower the spindles.



## New production efficiency starts with Kearney & Trecker Milwaukee machine tools

This typical example proves you can reduce costs and start on the road to higher production with machines designed and built by Kearney & Trecker's Special Machinery Division. With more than 50 years' experience in machine design and manufacture, Kearney & Trecker has all the ingenuity and skill required to solve special machining and production problems.

Why don't you take advantage of our abilities? They can pay off in profits for you. Your Kearney & Trecker Special Machinery Division representative will be pleased to give you all details. Call him today!

*For more details on the machine illustrated ask for Data Sheet No. 1044. The free booklet "Doorway to a proven method for solution of big and small metalworking problems" is also yours for the asking.*

KEARNEY & TRECKER MILWAUKEE

*Special Machinery Division*

MILWAUKEE 14, WISCONSIN, U.S.A.

***Builders of Precision and Production Machine Tools Since 1898***

# NEW DEVELOPMENTS AT ICI

(*Continued from page* 61)

superior metal components to withstand the stress and strain of modern applications."

Vacuum melting is indicated where it is essential to: have ingot soundness; formulate difficult compositions; provide higher alloy content than is possible with conventional methods; and superior physical properties.

Physical properties of vacuum melting process materials were discussed by A. J. Kiesler and W. F. Moore of General Electric. They stressed that special alloys, meeting the requirements of high temperature operating conditions are possible only with vacuum melting procedures. Tensile properties, ductility, and fatigue strength are greatly improved; and forgability of metals such as titanium and aluminum improved by 50 to 70 per cent due to clean ingots. Another important attribute of vacuum melting is that reproducible results are obtained from one heat to another.

In the preparation of ingots of 446 and 430 stainless steels, Moore reported less brittleness at room temperature. 52100 steel prepared by vacuum melting shows an improvement of four times the normal value for fatigue life.

Vacuum casting techniques, on the other hand, are still in the experimental stages, although many specialists in the field are doing work with the process at the present time.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# THEY ARE BOTH THE SAME

TEST BAR

in CHEMISTRY & PHYSICALS

PRODUCT CASTING

## When the Metal is FRONTIER 40-E* Aluminum Alloy

*Reg. T. M.

Whether you purchase Frontier 40-E Aluminum Alloy castings direct or from a foundry licensed to produce this alloy, you can be sure that the high qualities that have made this alloy famous are being maintained. How is this controlled? Test bars are required from all licensees. These are sent to the technical research laboratory of the Frontier Bronze Corp. for complete analysis and physical testing.

One of the most unusual features of Frontier 40-E Aluminum Alloy is the fact that the physical properties which spell high quality in the test bar appear uniformly throughout a large casting. And since Frontier 40-E is a non-heat-treated aluminum alloy the high strength physical properties are obtained by natural aging at room temperatures. The high yield strength of Frontier 40-E Aluminum Alloy is of special value in designing parts that must be light in weight and yet resist distortion or deformation.

*Yes, the test bar mirrors the quality of the product casting . . . here's proof.*

| FRONTIER 40-E | TEST BAR | CASTING |
|---|---|---|
| Yield Strength | 23,500 | 22,700 |
| Tensile Strength | 36,600 | 35,500 |
| Elongation | 7.5 | 7.5 |

Please send me a copy of the Alloy Data Book giving Engineering and Metallurgical Facts on the physical properties of Frontier "40-E".

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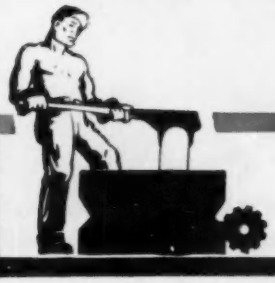

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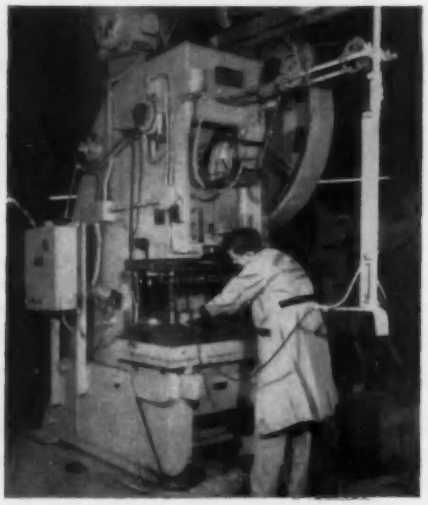


Below—*Robert Lonze, partner in Era Tool & Engineering, and Raymond Heldt, plant superintendent, looking over a scale case that has just been shaped on the Warco 150 ton Straight Side Press in background.*

### *Leading Chicago metal fabricator likes Warco Press dependability!*

"The demand for fast production of a wide variety of stampings calls for most dependable press equipment and that's why we like Warco Presses." This from Robert Lonze, partner in Era Tool & Engineering Co., of Franklin Park, Illinois, one of the Mid-West's leading metal fabricators.

"We first became acquainted with Warco during the war. The ease of operation acclaimed by our press operators, plus the extremely low maintenance requirements, were two of many outstanding features that thoroughly convinced us Warco builds rugged, practical and dependable press equipment.

"Whenever the need for an additional Press arises, we here at Era Tool will give Warco first consideration."

Federal® WELDERS

**The Federal Machine and Welder Company**

Warco® PRESSES

WARREN, OHIO

OSBORN BRUSHING METHODS *worthy of your confidence*

# Solving an inside job

Sectioned Before Brushing

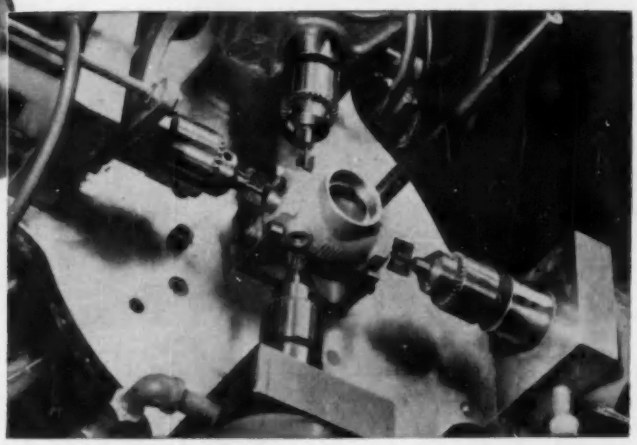
Sectioned After Brushing

*Power brushing cleans these four threaded holes 66% faster than previous method.*

● Removing burrs and metallic particles from threads inside this valve body was once a tedious, time-consuming hand operation.

Today, using Osborn Situft® Brushes and a simple power brushing setup, the four threaded ports in this valve are deburred and cleaned in one operation . . . *saving eight manhours per 1000 parts.*

This and hundreds of other metal cleaning and finishing improvements made possible by power brushing are the reasons why Osborn has earned industry's confidence. **An Osborn Brushing Analysis**, made at no obligation, will show how *you* can make substantial savings on many types of production with Osborn Power Brushing. Write *The Osborn Manufacturing Company, Dept. E-47, 5401 Hamilton Avenue, Cleveland 14, Ohio.*



Osborn Brushes

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*Photo courtesy Hydraulic Press Mfg. Co.*

When you specify Youngstown Cold Rolled Sheets and Strip you get a product of uniform high quality. Tested and inspected at every step in Youngstown's fully-integrated operations, they are held to rigid high standards of ductility, tensile strength, flatness and surface finish — which guarantees you an almost continuous production of even the most difficult-to-form parts. This makes for increased profits, greater production, lowered costs and an improvement in over-all product quality.

For additional information or metallurgical assistance, call or write your nearest Youngstown District Sales Office—or write direct to our Home Office.

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# "I, sir, wash my own car!"

This car washing is a great American hobby. As soon as one man starts, you find the whole neighborhood outside, kinking the hose, sloshing through puddles, having fun. They wield an incredible array of long-handled brushes, sprays and mops, assisted by a witches brew of foaming detergents, cleaners, waxes, powders, pastes, liquids and creams.

When the car is washed, the man of the house begins an inch-by-inch check of the glittering trim. Does it really shine? Or does it blister? Or peel?

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When your trim is made from Stainless Steel, you can make these promises in all good faith. People know what Stainless is, for they use it every day in the form of flatware, pots and pans, sink tops and the like.

The beauty is more than skin deep when you use trim made from service-tested USS Stainless Steel. There's a size and finish for every possible need.

See "THE UNITED STATES STEEL HOUR"—Televised alternate weeks—Consult your newspaper for time and station.

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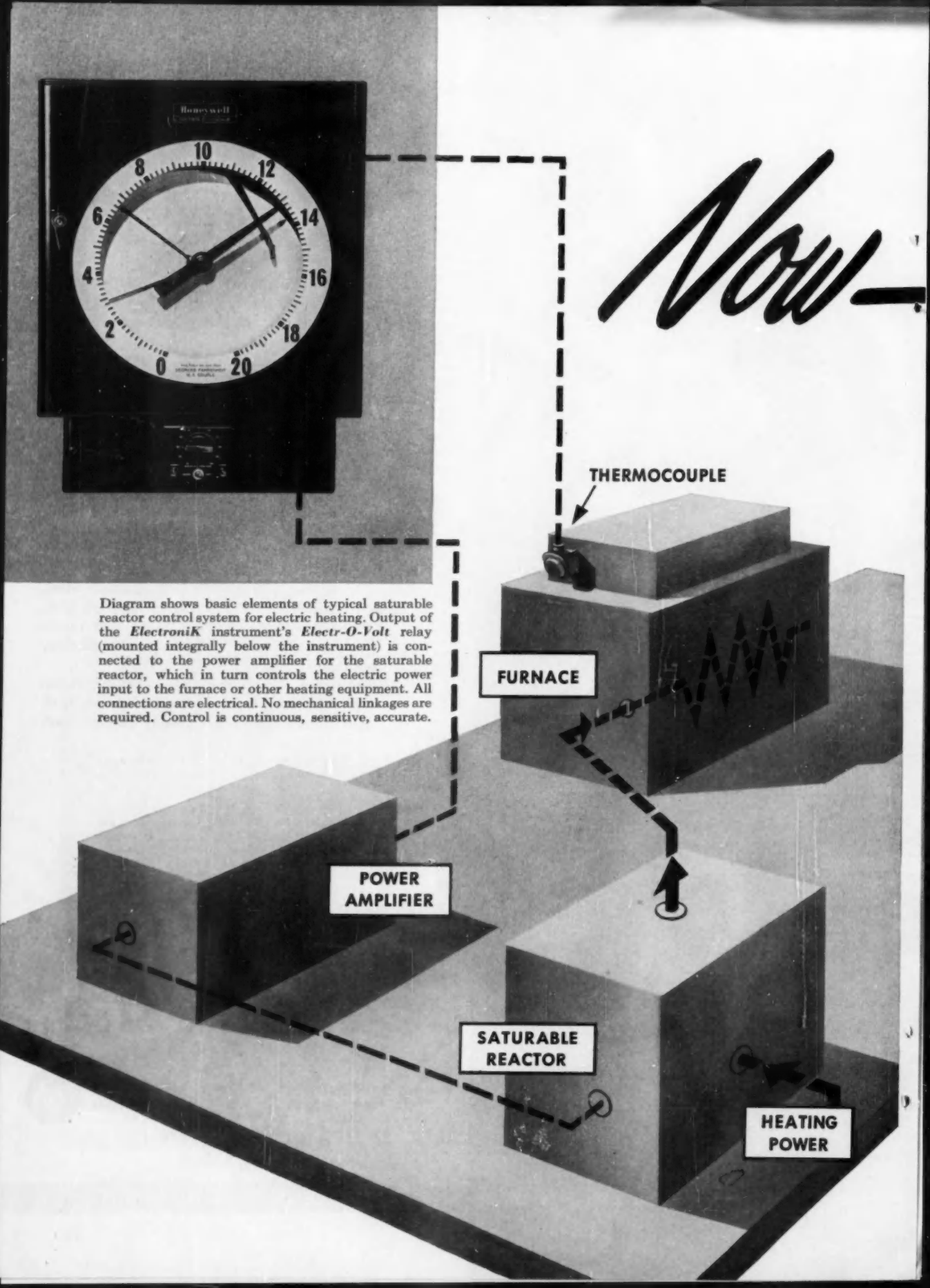


Diagram shows basic elements of typical saturable reactor control system for electric heating. Output of the *ElectroniK* instrument's *Electr-O-Volt* relay (mounted integrally below the instrument) is connected to the power amplifier for the saturable reactor, which in turn controls the electric power input to the furnace or other heating equipment. All connections are electrical. No mechanical linkages are required. Control is continuous, sensitive, accurate.

# continuous, accurate control of electrically heated equipment

## *ElectroniK* instrumentation with Electr-O-Volt* relay provides continuous throttling in saturable reactor control systems

You can now regulate temperatures of electrically heated furnaces, ovens, and similar processing equipment within exceptionally close tolerances, by using an advanced *ElectroniK* control system in conjunction with saturable reactors. This type of control eliminates the abrupt surges of power and the expense of contact replacement which are frequently objectionable factors of on-off or pulsed electric control.

***Continuous control action.*** The *Electr-O-Volt* relay, actuated by the *ElectroniK* instrument, provides continuously variable control input to the saturable reactor power amplifier. This arrangement gives true proportional-plus-reset control action, which adjusts heat input to compensate for size of load, ambient temperature and other transient and long-term variations in heat demand.

***Completely electronic.*** The system has no mechanical linkages, contactors, or other complex moving parts. Its high speed and sensitivity give the precise control required by modern processes.

***Broad range of use.*** *ElectroniK* control for saturable reactors is applicable to high-temperature heat-treating furnaces, reaction vessels and many other types of electrically heated equipment. It makes possible smooth, finely-adjusted regulation of electric power at high efficiency.

For a discussion of how this control can be applied to your specific problems, call your local Honeywell sales engineer. He's as near as your phone.

Minneapolis-Honeywell Regulator Co., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

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● **REFERENCE DATA:** Write for Catalog 1531, "*ElectroniK* Controllers," and for new Specification 5152-2—"*ElectroniK* Instruments with Electr-O-Vane Proportional Control."

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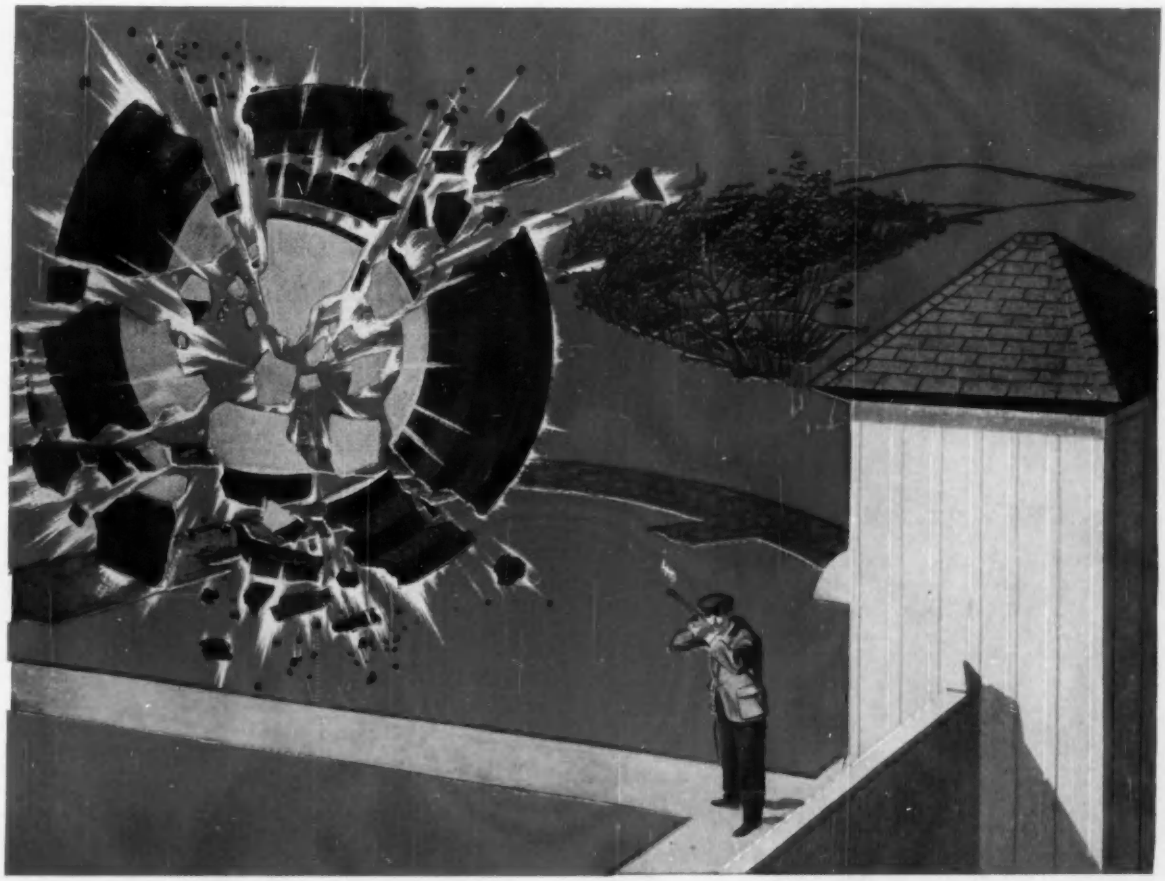

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Use this steel in your own shop to secure better work at lower over-all costs. Results will convince you "J&L 1200" deserves to be a regular specification for your production runs.

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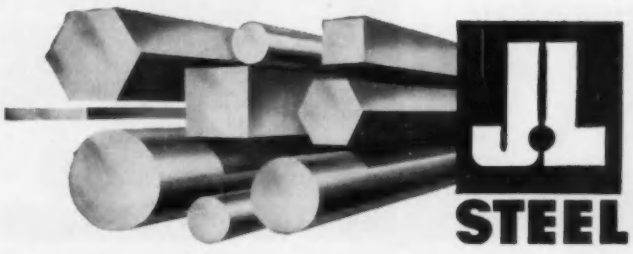


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TUNG-SOL VISION-AID HEADLAMP
12 VOLT 5400-S
WITH E-Z AIM PLATFORMS

# WITH E·Z AIM PLATFORMS

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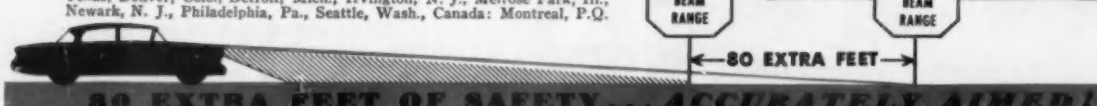


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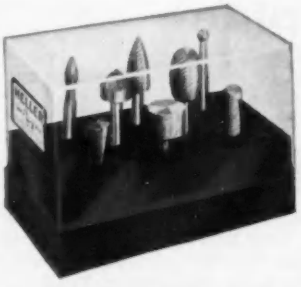

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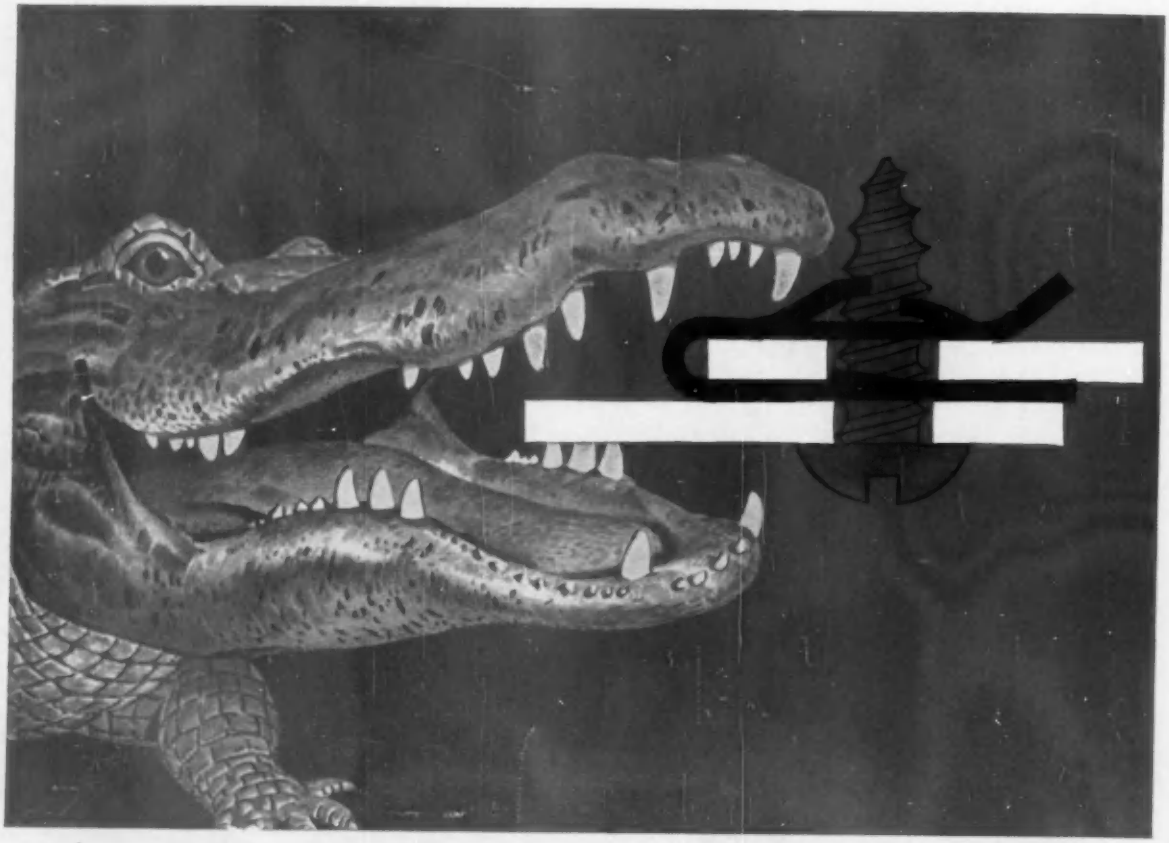

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## fasten a fastener in place

Alligator jaws have nothing on Tinnerman "U" and "J" type fasteners in gripping power. These fasteners press easily into locked-on position over panel edge or center panel locations. Yet they provide positive self-retention, ending the need for welding, staking or other secondary fastening devices. They are ideally suited for blind assembly or hard-to-reach locations.

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Find out about these and more than 8,000 other types of SPEED NUT brand fasteners now serving industry all around the world. They can make important savings for you, can also simplify your assemblies. See your Tinnerman representative soon or write to us. **Tinnerman Products, Inc., Box 6688, Dept. 12, Cleveland 1, Ohio.**

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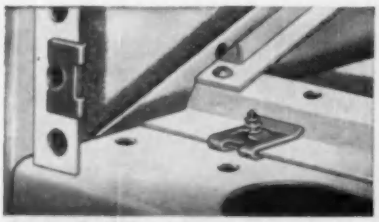
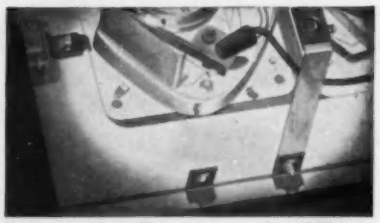
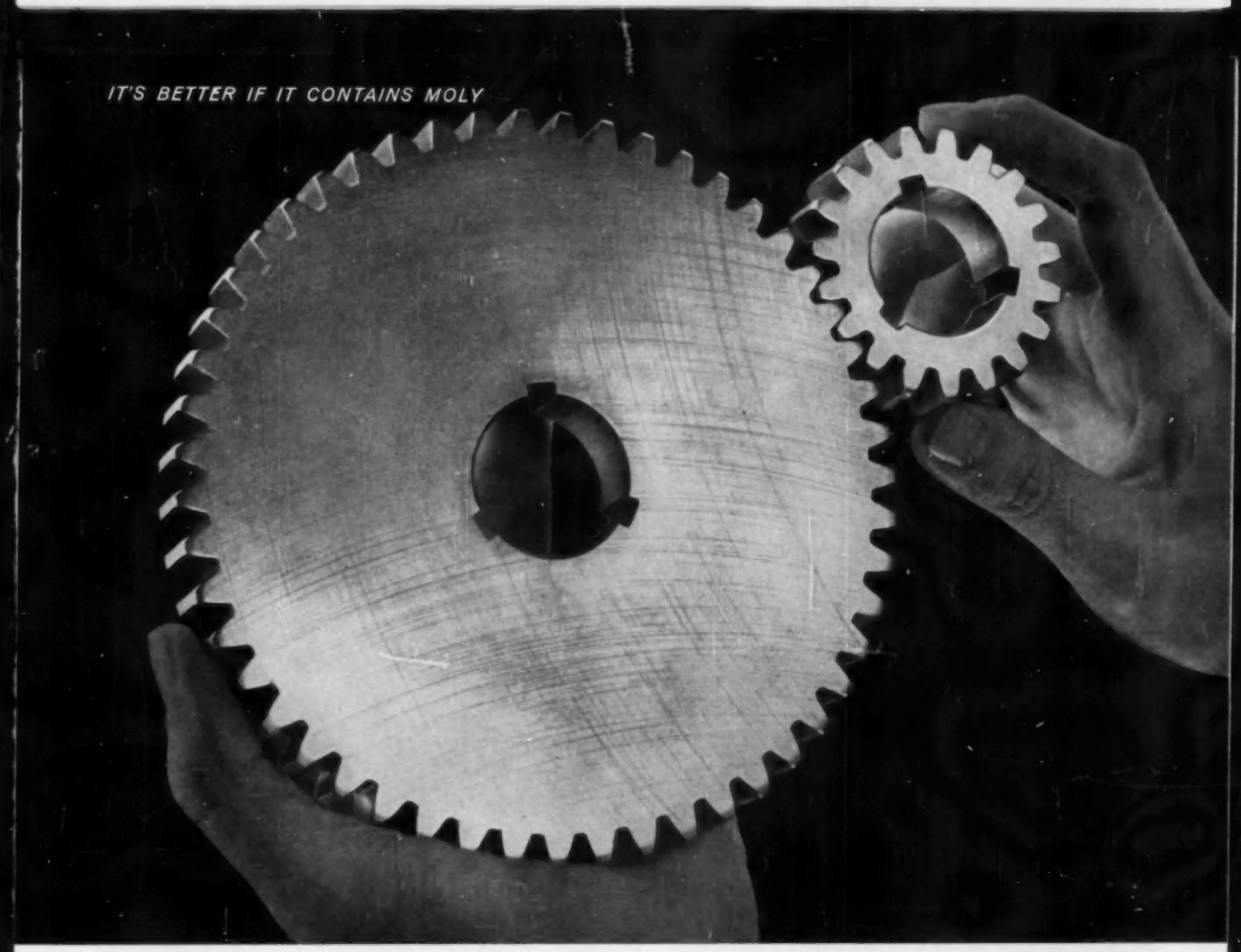


Greater flexibility for control equipment enclosures is provided by self-retaining "J" type SPEED NUTS at 30% less production cost.

Assembly costs on this sheet-metal skylight frame are reduced 66% by Tinnerman "U" type SPEED NUTS.



Gas range assembly costs are reduced 25% to 50% by using Tinnerman "U" and "J" type SPEED NUTS.




# Up to 1% Moly in carburizing steels gives required hardenability economically

Why limit the use of molybdenum to the .15/.25% Mo and .20/.30% Mo contents of the traditional grades? For the contributions of moly do not stop there. Laboratory tests and production runs prove that as molybdenum contents increase up to 1%, hardness increases progressively. A wide range of case and core hardenabilities, therefore, can be obtained – economically, too.

Tests with a series of molybdenum-manganese steels show that these compositions give higher case hardness on a direct quench than other steels of comparable core hardenability. One extensively tested composition, for example, is 0.5% Mo – 0.5% Mn steel. It shows longer life, and is lower in cost than steels previously used. And it produces a higher case hardness with similar or less distortion. What's more, tool life and surface finish are equal or better. Good reasons why several companies have already adopted this grade for automotive gears and other critical applications.

If you use carburizing steels, see what a higher molybdenum content can do for you. Part of the story is contained in the technical article "New Carburizing Steels For Critical Gearing." For your copy, or other technical data, write Climax Molybdenum Co., Dept. 4, 500 Fifth Avenue, New York 36, N. Y.

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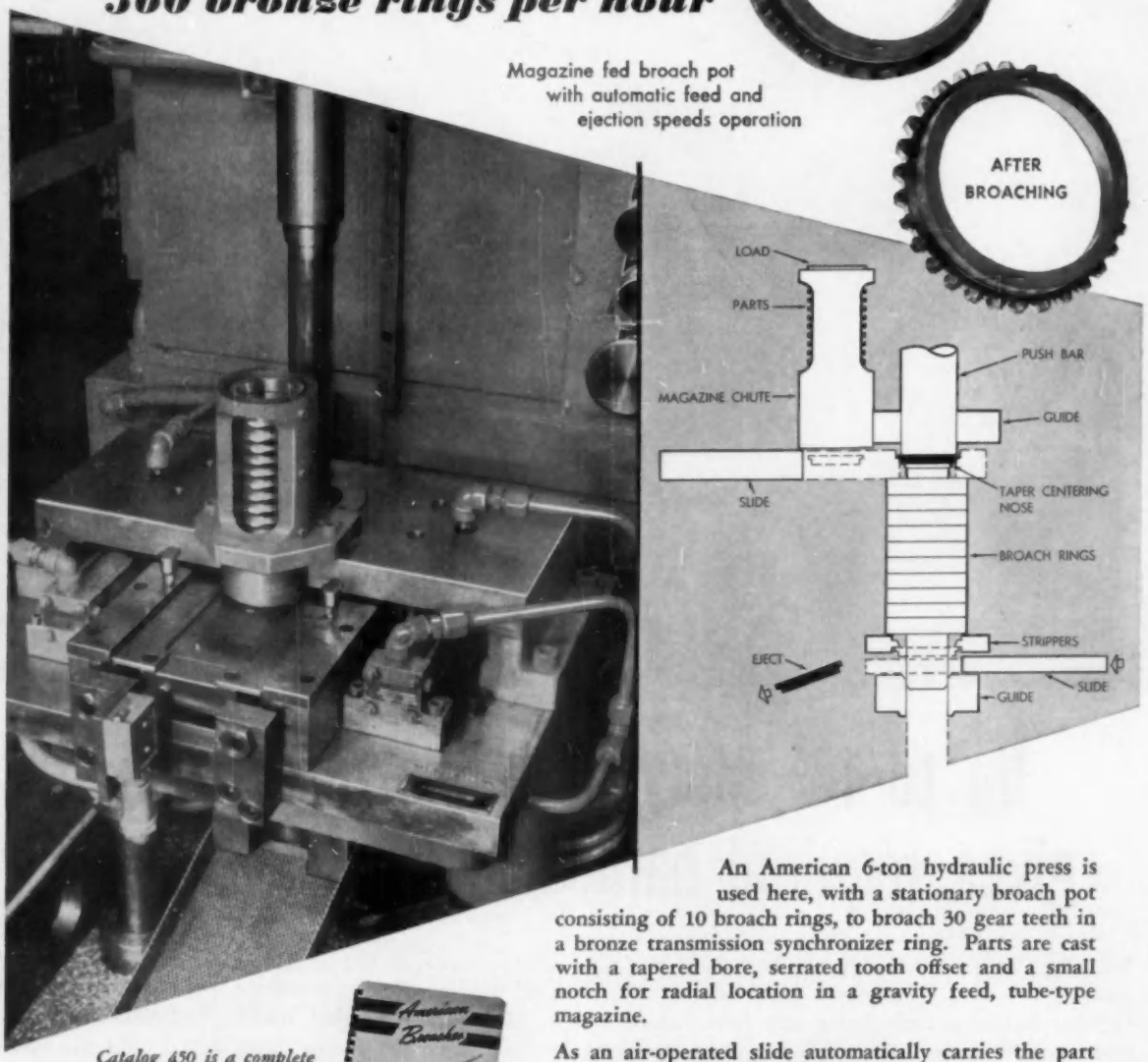
ANOTHER *American* FIRST

## *30 gear teeth broached*

IN EACH OF

## *360 bronze rings per hour*

Magazine fed broach pot with automatic feed and ejection speeds operation




An American 6-ton hydraulic press is used here, with a stationary broach pot consisting of 10 broach rings, to broach 30 gear teeth in a bronze transmission synchronizer ring. Parts are cast with a tapered bore, serrated tooth offset and a small notch for radial location in a gravity feed, tube-type magazine.

As an air-operated slide automatically carries the part into broaching position, the ram of the press descends and a push bar, engaging the tapered bore of the part, forces it through the broach pot. During the cutting operation the push bar is guided above and below the broach pot. Stripper fingers remove the part as the push bar returns. Ring is ejected by a second slide.

*Catalog 450 is a complete and interesting manual on all types of broaching. Write for your copy today.*

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Moly Key to better carburizing steels

- hardenability
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- Low distortion
- Good machinability
- Good wear resistance

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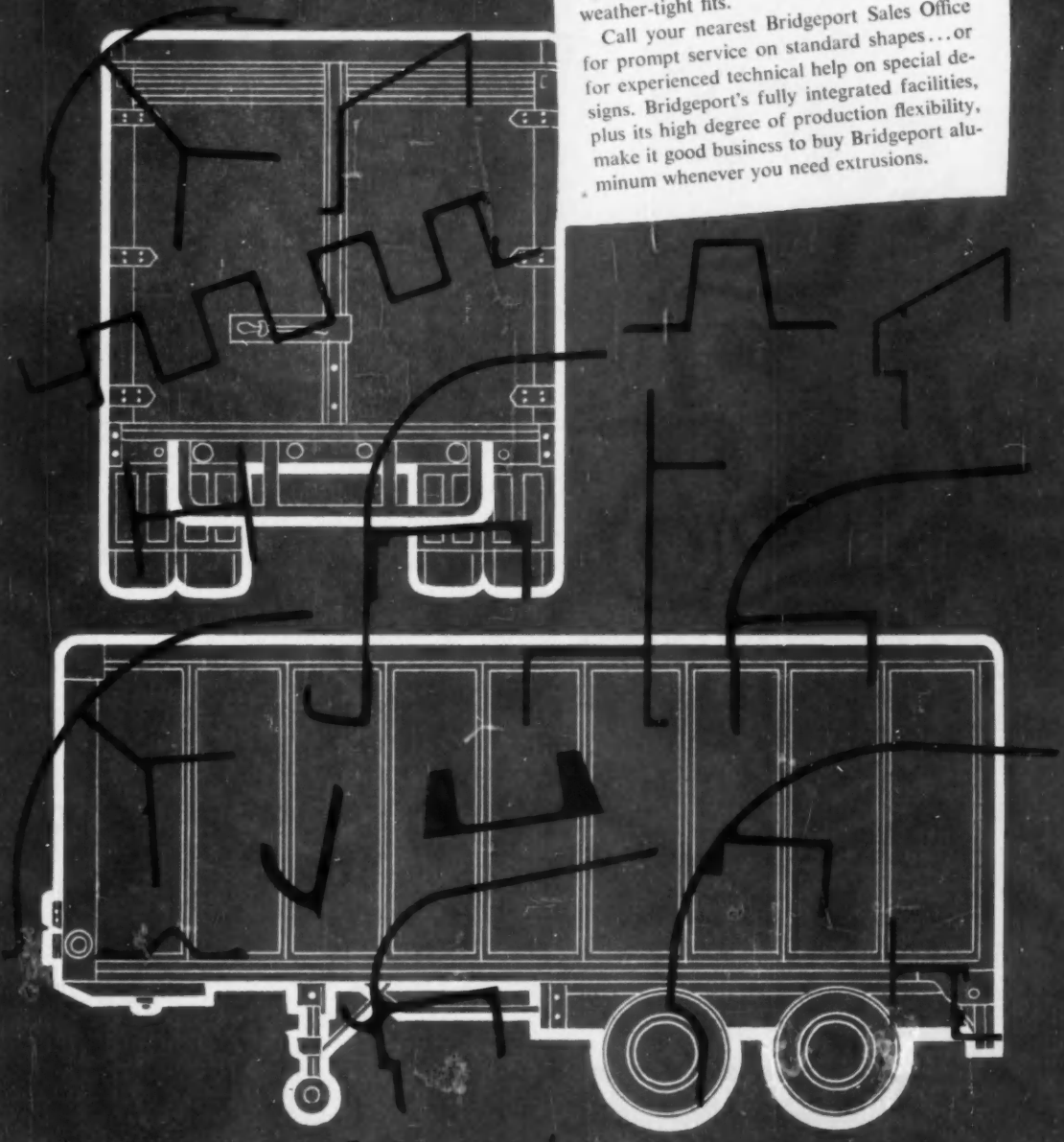
The shapes shown here are just a few of Bridgeport's wide range of standard aluminum extrusions for truck and trailer bodies—all available without die charge.

You'll do well to specify Bridgeport Aluminum for shapes engineered to meet the most precise design and production requirements. They combine light weight, strength and rigidity with fast, easy assembly for secure weather-tight fits.

Call your nearest Bridgeport Sales Office for prompt service on standard shapes...or for experienced technical help on special designs. Bridgeport's fully integrated facilities, plus its high degree of production flexibility, make it good business to buy Bridgeport aluminum whenever you need extrusions.



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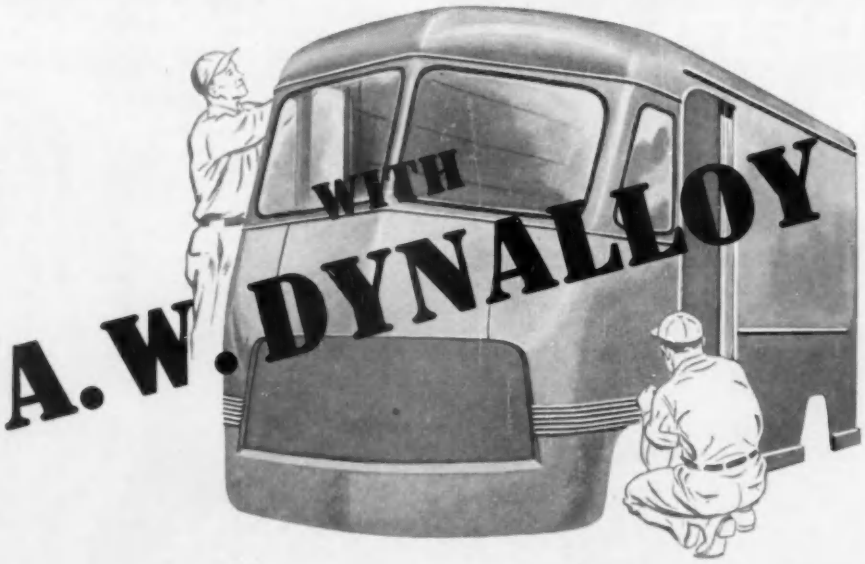


## ...to take a beating

You'll find that phrase—"Better Built"—almost everywhere delivery trucks are sold. It's the hallmark of Boyertown Auto Body Works, of Boyertown, Pa., who have been building better vehicle bodies for more than 83 years.

Boyertown looks to Dynalloy—a product of Alan Wood Steel Company, for the high-strength, low-alloy steel that means greater toughness and durability in its bodies.

For the finely finished press-formed sections that are the backbone of its bodies, Boyertown looks to Parish Pressed Steel whose uniform fabrications give custom perfection at mass-production cost.

These three famous names—Alan Wood, Parish and Boyertown—add up to greater strength, lighter weight, lower cost and longer life in your next delivery truck body.

More strength—per pound—per dollar!

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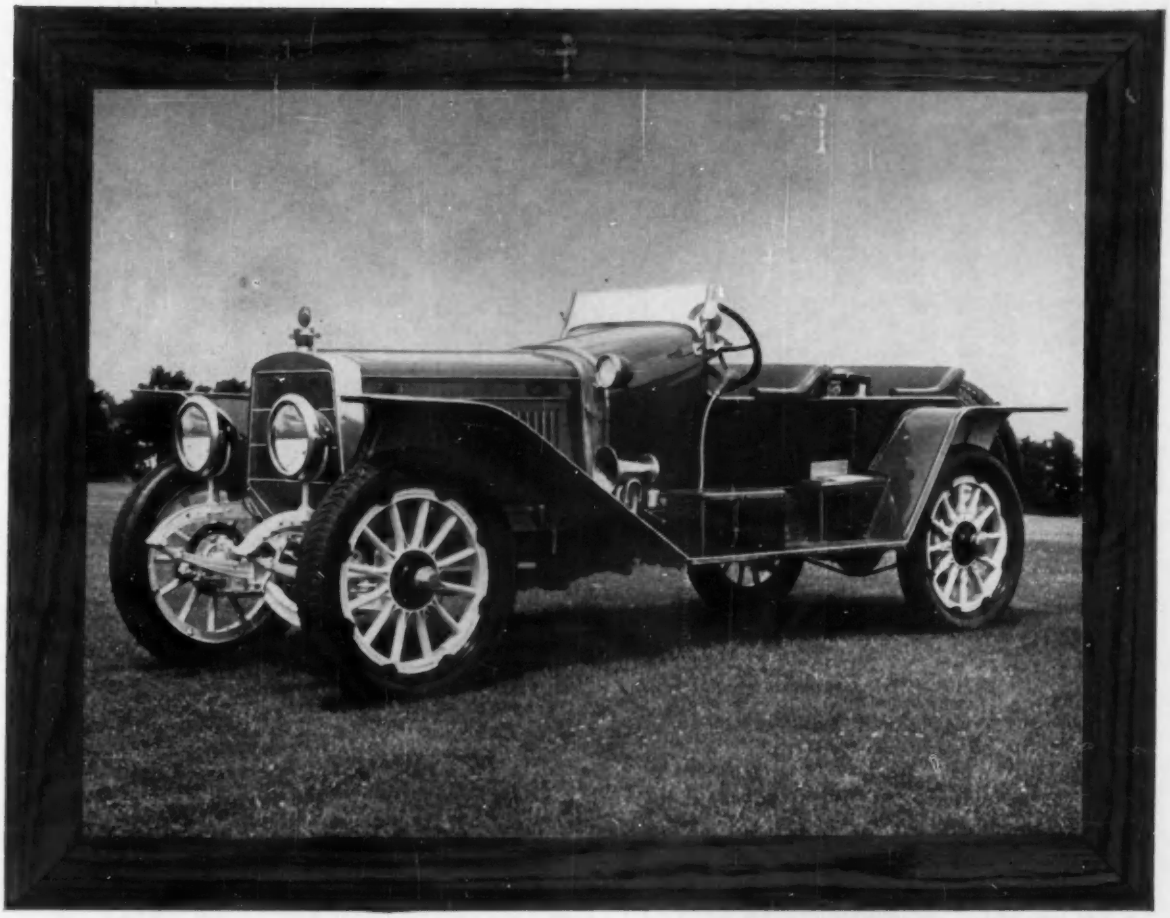

*Send for free print—1913 Lozier. This print, from collection of P. S. DeBeaumont, not for commerciol use.*

"Legitimately high-priced," the 1913 Lozier cost over $5000. It featured a modified toy tonneau body, a T-head six-cylinder engine with 51 h.p. and a top speed of 81 m.p.h. Ignition was dual battery and magneto. From 1907 to 1911, the Lozier maintained an enviable racing record. This is one of a series of antique automobile prints appearing in Morse advertisements. Write for your free copy, suitable for framing, to: Morse Chain Company, Ithaca, N.Y.

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**If you have problems** involving timing chain in design, development or application, check first with Morse. We have expert engineering service available to help you solve them quickly, profitably.

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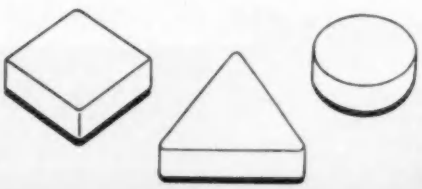

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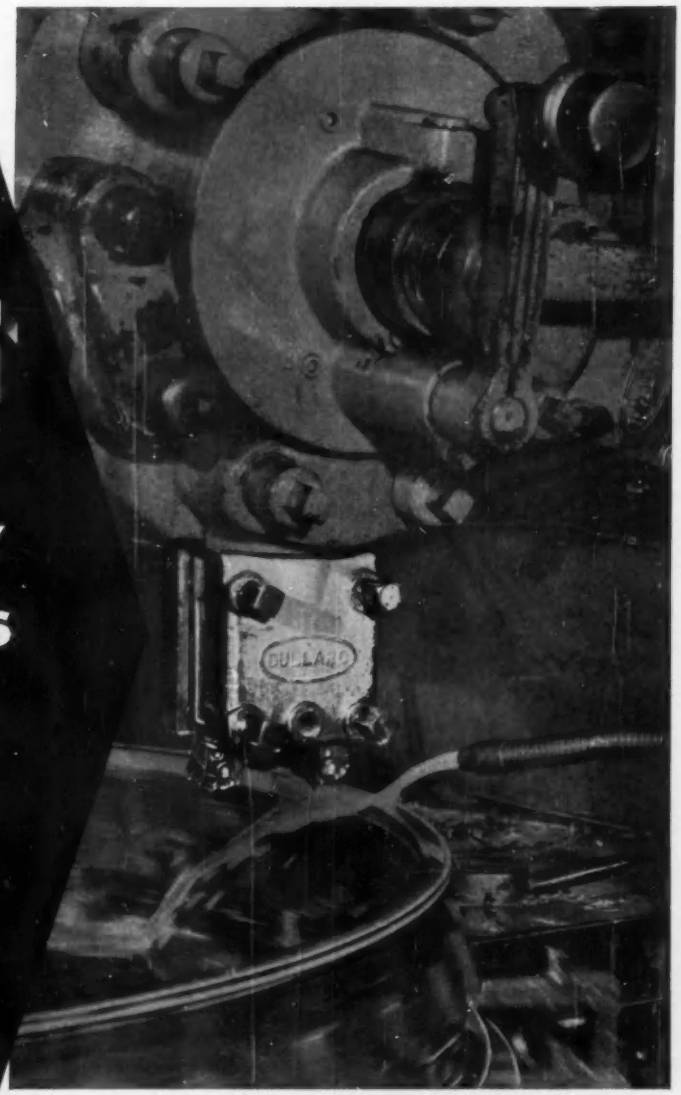

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A leading West Coast manufacturer now uses Carmet CA-610 tool blanks for machining components of jet engines and gas turbines. Since switching to this special steel-cutting carbide grade, production has sharply increased from 28 parts per blank *to more than 80.*

Carmet throw-away blanks are designed for any type of tool holder. This same manufacturer reports that the ease and speed with which used blanks may be exchanged for new ones has reduced downtime for tool change-over by 7%.

Advantages such as these are important in *your* industry, too. Call your Carmet dealer TODAY for his advice on any production problems you may have . . . or write *Allegheny Ludlum Steel Corporation, Carmet Division, Detroit 20, Mich.*

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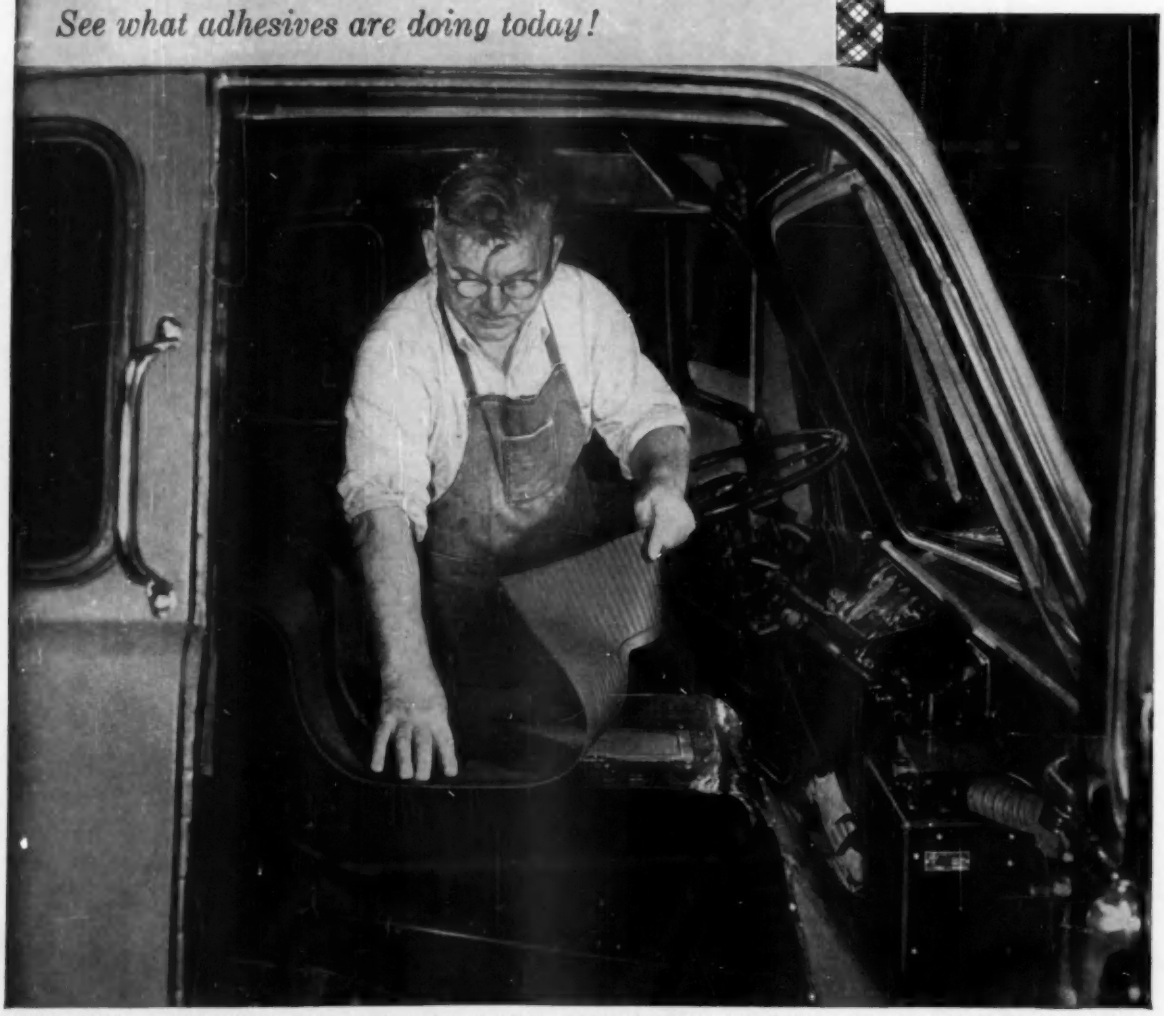

A 3M ADHESIVE FASTENS DOWN THIS RUBBER MAT FOR KEEPS. IT'S CLEAN, QUICK AND EASY, MAKES NO MESS IN THE CAB INTERIOR.

# Dressing up the "doghouse"

How would you fasten the trim on this truck engine cover? The fastener must fight heat, stress and vibration. And it has to be able to hold this rubber mat tight year after year, for hundreds of thousands of punishing miles.

*Yet a 3M adhesive does the job.* This worker quickly brushes EC-882 on the painted "doghouse", presses the rubber mat in place. High-strength, fast-drying EC-882 grips immediately and for keeps. In addition, EC-882 bonds rubber weather strip to the cab's enameled doors and door frames.

Another 3M adhesive, EC-871, fastens fibrous glass insulation to the cab roof and vinyl-coated jute to back and side panels. After 15 years of using 3M adhesives, this manufacturer can't recall one case of adhesive failure.

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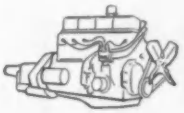
*Imagineering the 195X models . . . in Alcoa Aluminum*



# Are solid aluminum bearings the key to stiffer, better balanced crankshafts?

Someday soon, engineers will design an automobile engine using aluminum bearings for connecting rods and mains. They'll be solid aluminum.

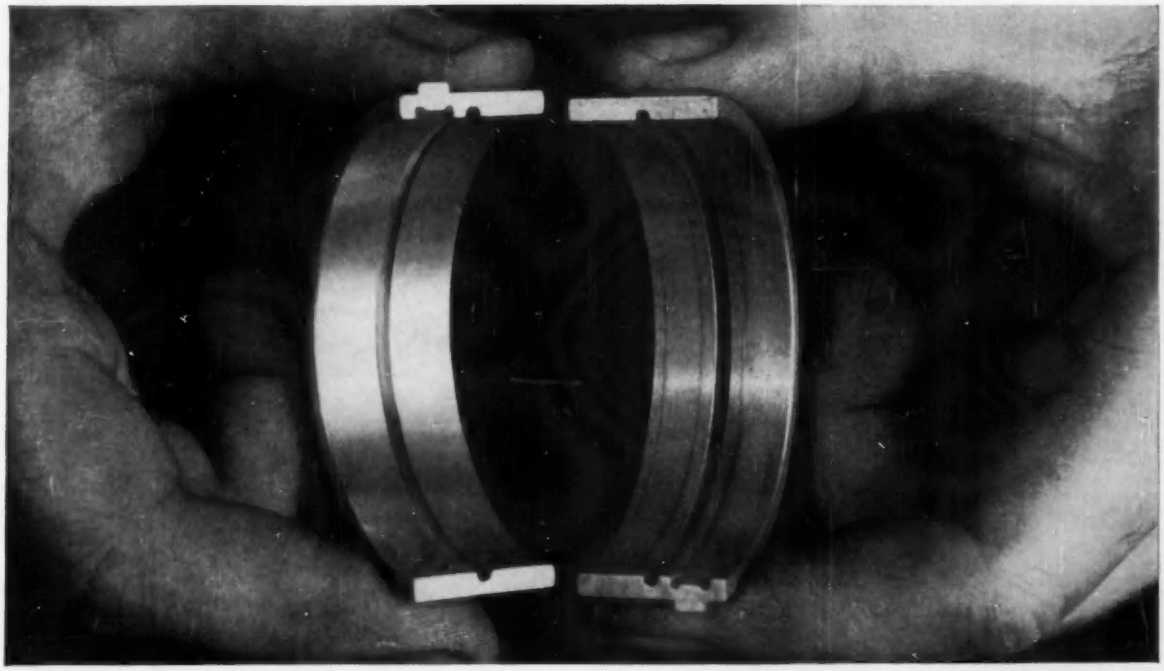
This new engine will be better and more economical because solid aluminum bearings will make it possible for engineers to design a better crankshaft. Here's why that's true:

Solid aluminum bearings carry very high loads. In a nonautomotive engine now widely used, aluminum bearings are supporting 10,000 psi. This is far more than automotive bearings now support. It means that aluminum can support the loads that result from higher horsepower. But more important, it means that with aluminum, the bearing area can be reduced.

Cutting down on bearing area allows you to put more metal in the crankshaft web. This results in a stronger, stiffer, more durable crankshaft. More throw space is available for balancing. Main bearing saddles are narrower, improving alignment and increasing strength.

Aluminum offers these bonus benefits. Additives in some extreme pressure lubricants corrode many metals but have no effect on aluminum bearings. And very important, aluminum is a good conductor and carries away heat fast. Bearings can be operated at higher temperatures.

We know that someday soon, *some* engineers are going to get a better engine by designing for aluminum bearings. When they do, the Alcoa Development Division will be the place to go for help in imagineering better bearings for 195X (or '6X) models . . . from Alcoa® Aluminum.



Alcoa engineers took a standard production engine and installed main and connecting rod bearings of solid aluminum. At the end of a test equivalent to 150,000 miles driving, all the bearings were in good condition. At the left is a brand-new bearing. At the right is a bearing used in the test. Suggestion: For better bearings, let our superbly equipped Development Division help *you* imagineer solid aluminum bearings. Aluminum Company of America, 1841-M Alcoa Building, Pittsburgh 19, Pa.

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This year's exciting new automobiles incorporate more stainless steel than ever. That's because stainless is the one metal that's never touched by wear . . . corrosion . . . and weather extremes.

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Stainless steel is functional as well as ornamental. Stainless trim has lasting built-in beauty. And functional components made of stainless have proved their rugged economy.

Ask your supplier for particulars. You can be sure that the Finest Stainless Steels are made with Vancoram Ferro Alloys.

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AUTOMATION for the pressroom is just around the corner according to a number of the nation's leading press experts who have studied the revolutionary "Flying Press" approach recently announced by the Wean Equipment Corporation.

Taking a coil of steel directly from the mill, the Wean Flying Press Line decoils, levels, measures, blanks, sorts, counts and piles the finished piece on trans-car ready to be rolled to the next operation—at a speed heretofore considered unobtainable.

Present engineered lines will handle coils up to 72 inches in width—cutting lengths from 12 inches to 8 feet.

If low cost, mass production stamping appeals to you, why not contact a Wean Equipment engineer for full particulars? Write direct or call the Wean office in Chicago, Detroit or Newark, N. J.

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# STEEL CASTINGS...

Take a good look at sources for steel castings. Can they adequately supply your needs now—and in the future? How about their other customers—when demands are high do you come first, second—or where? Are they "up" on quality control—do they have extensive production facilities—can they manufacture at lowest possible cost?

Take a look at Campbell, Wyant, and Cannon. Here is a foundry that can produce over 150 tons of steel castings a day . . . that can take care of your requirements and those of many others today and tomorrow. Modern equipment and complete facilities make it possible to economically cast steel in limited quantities or volume —in a variety of sizes and shapes. And no other foundry can surpass CWC's abilities in quality control. For example, CWC is the first foundry to employ the spectrographic analysis of metals—an important time and cost saving method. Castings are radiographed by a million volt x-ray to assure adherence to the most stringent specifications. Extensive heat treating facilities are available to provide required metallurgical structures. A research foundry helps to decide many things before actual production starts. These, and many other control measures, enable CWC to make steel castings of highest quality at low cost.

So take a good look at Campbell, Wyant and Cannon. Talk over your steel casting requirements with a CWC engineer now. Phone us at Muskegon 3-1331 or write:

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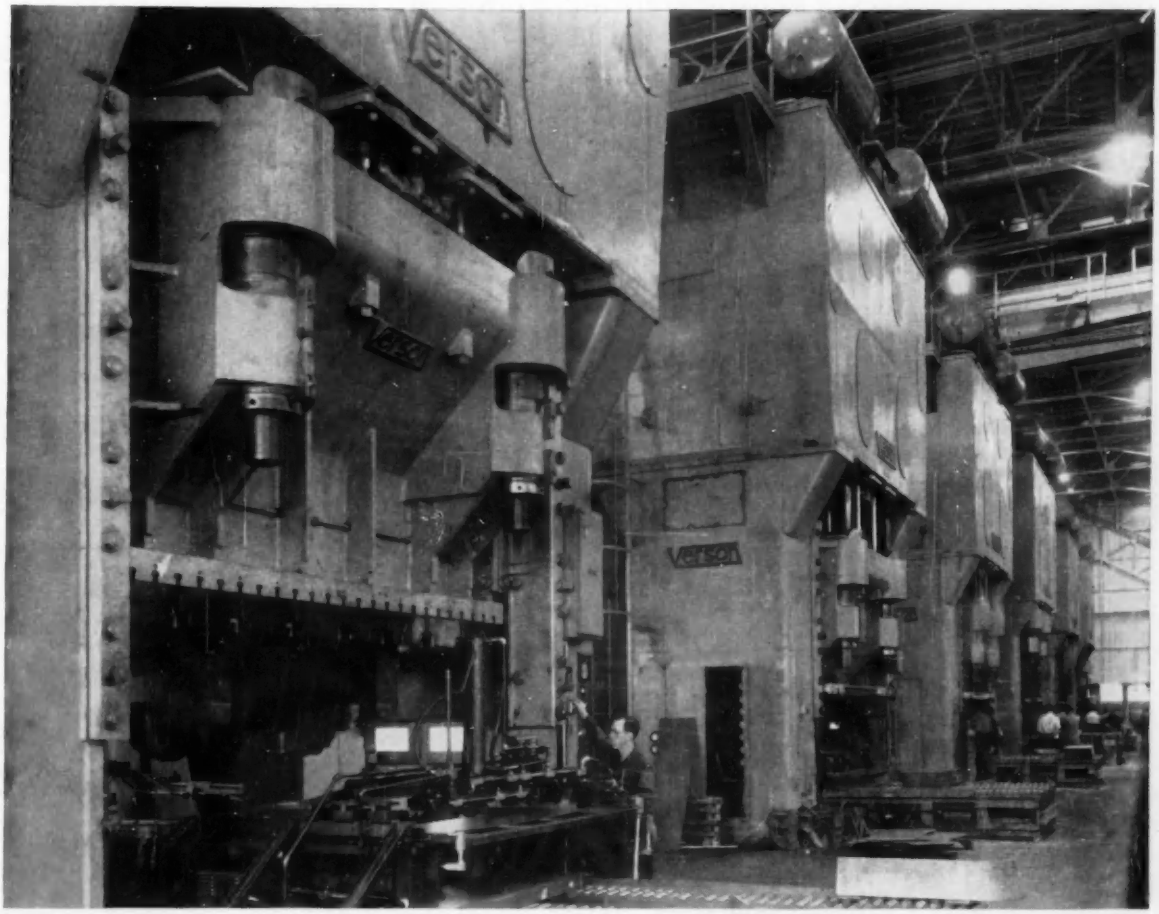


# Could you compete with a press room like this?

## the RISING COST of Obsolescence

Obsolescence is the creeping malignancy of manufacturing. The longer it goes unchecked, the weaker its victim becomes, the more costly the cure. Recent developments by Verson in the press forming of metals have obsoleted processes that were the most efficient available a few short years ago. Check your plant for symptoms.

Competition that reaches its culmination in the market place often begins in the shop. Here is where a large measure of your competitive price position is determined. Here is where profits can be made—or lost.

**What's the answer?**

The answer is a *planned* program of modernization of your production processes. Sit down with your suppliers and develop a program for systematically replacing inefficient, obsolete methods. Generally, you need not replace it all at once. Very often one machine at a time can be replaced, just so it is done to a well developed plan.

In your press room, sit down with Verson. Put Verson experience in the development of production processes to work for you. Utilize the know-how that results from Verson's approach to press building—"Anyone can build a press, Verson builds production processes". Write or phone for further information.

*A Verson Press for every job from 60 tons up.*

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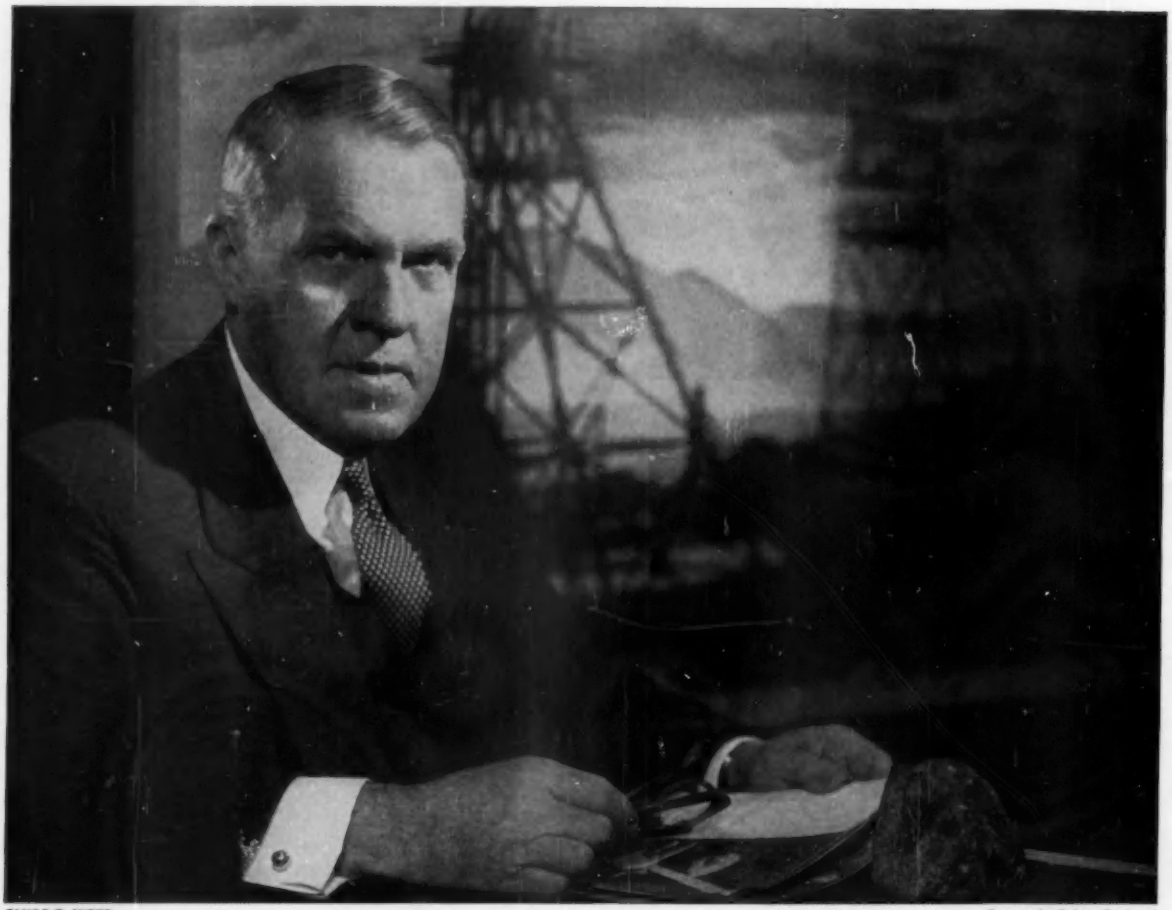

CLYDE E. WEED

*Portrait by Fabian Bachrach*

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"In October, 1955, only 34% (11,140) of the nearly 33,000 Anaconda organization employees in this country were buying U. S. Savings Bonds through the Payroll Savings Plan.

"Late in 1955, we conducted a simple person-to-person canvass which put a Payroll Savings Application Blank in the hands of every employee. There was no pressure, no special promotion – just the Application Blank. Our employees did the rest.

"Recently, our records showed that 22,514 of our men and women—69%—are now Payroll Savers. Every new employee is given a Payroll Savings Application Blank and an opportunity to join with his fellow workers in building personal security through systematic thrift.

"We believe The Payroll Savings Plan—with an enrollment of 8,000,000 employees of more than 40,000 companies—is a significant contribution to the Government's effort to check inflation and maintain a sound dollar."

**CLYDE E. WEED,** *President*
*The Anaconda Company*

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**AUTOMOTIVE INDUSTRIES**

# How to Control Corrosion on Bare Aluminum

Corrosion is a real threat to aluminum, especially to the higher strength alloys. It can be controlled by using a chemical surface treatment, with results as dramatically effective as those shown in the illustrations at the right.

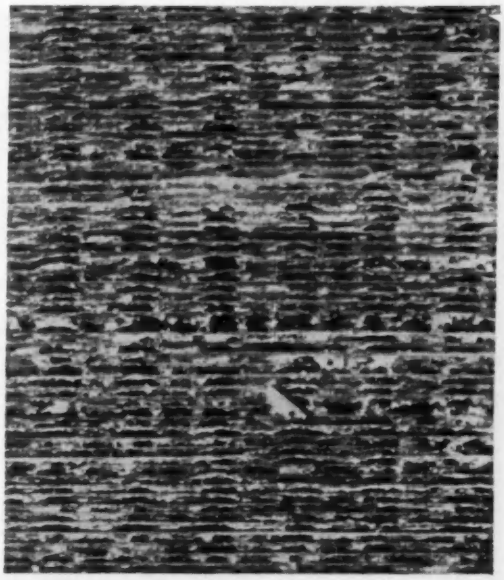
The corrosion protection is effected by Bonderite 710 or 720, applied by spray, immersion, or brush-on methods. A thin, iridescent coating, light to golden brown depending on the alloy treated, covers all surfaces of the aluminum and protects it against corrosion.

The coating produced by Bonderite is integral with the metal itself. It is flexible and can withstand moderate draws without difficulty. Arc and spot welding fabrication methods need not be changed, because the coating conducts electricity. It has good resistance to bimetallic and galvanic corrosion. Sheets, castings, forgings, extruded and rolled structural forms may be treated.

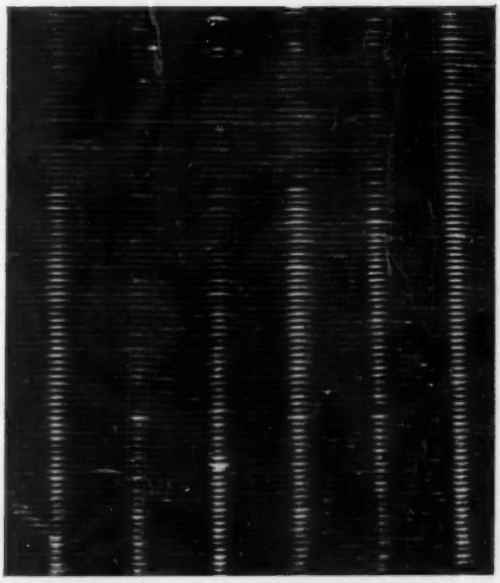
Bonderite 710 and 720 solutions are sludgeless, easily controlled, uniform in results.

These treatments may be used to increase the durability of paint finishes with equally outstanding effectiveness.

The Parker man in your territory has valuable experience to share with you in treating aluminum and its alloys. A letter or phone call will bring him to you.



**UNTREATED**—Unretouched photo of section of aluminum heat exchanger after 1150 hours in salt spray. Note corrosion.



**BONDERITE-TREATED**—Unretouched photo of section of identical aluminum heat exchanger after 1150 hours in salt spray. Note absence of corrosion.

*SINCE 1914—LEADER IN THE FIELD*

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PARKER RUST PROOF COMPANY
2178 E. MILWAUKEE, DETROIT 11, MICHIGAN

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|---|---|---|---|---|
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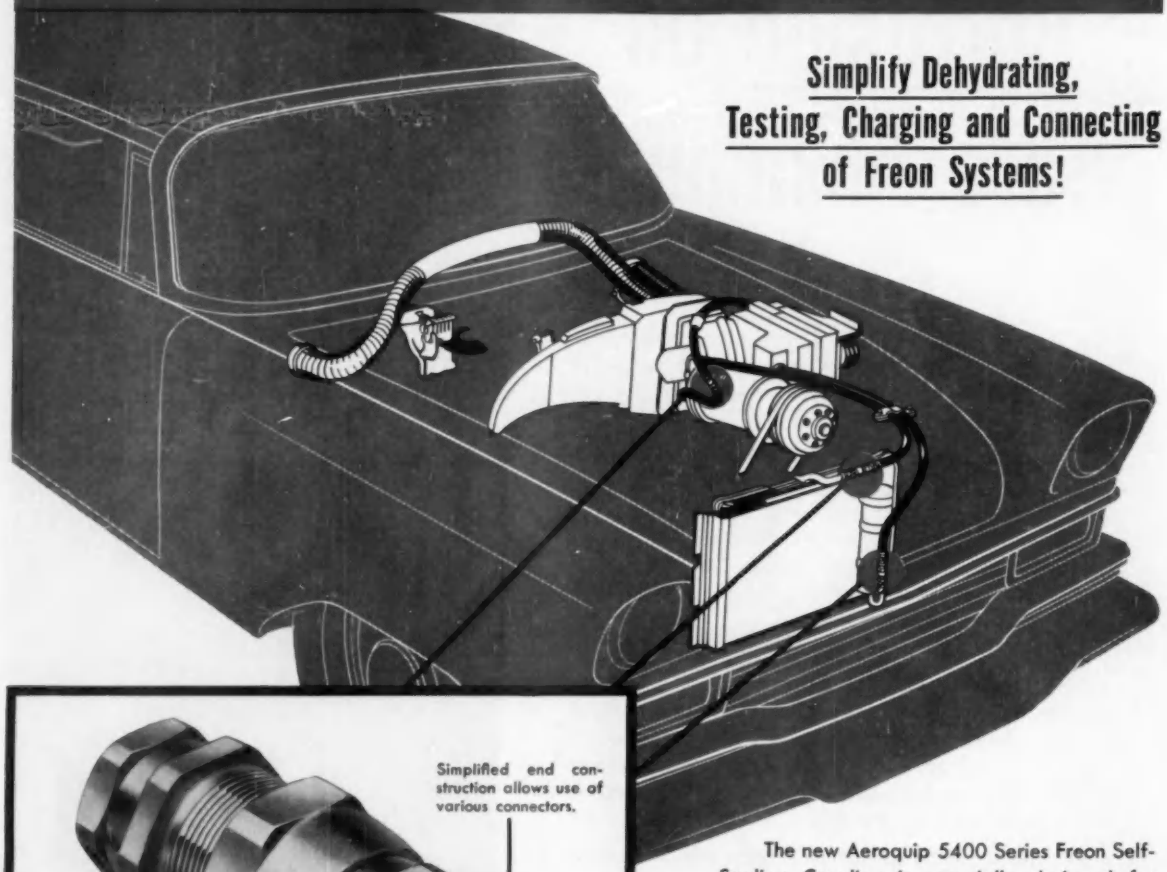
# NEW Aeroquip 5400 Series Self-Sealing Couplings Allow Quick Installation of Factory-Charged Air Conditioners



## Simplify Dehydrating, Testing, Charging and Connecting of Freon Systems!

Simplified end construction allows use of various connectors.
Hex union nut connects coupling halves quickly, opening full-flow valves.

The new Aeroquip 5400 Series Freon Self-Sealing Coupling is especially designed for automotive air conditioning units. It permits quick assembly line connection of precharged air conditioning components without loss of Freon or inclusion of air into the system.

Features of the low-cost 5400 Coupling include extremely low pressure drop, cartridge-type valves and a compact, lightweight body.

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Aeroquip

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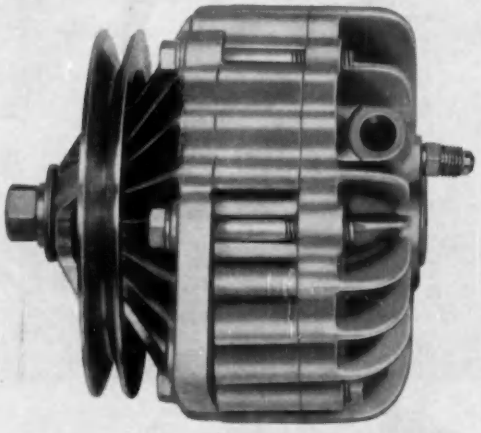
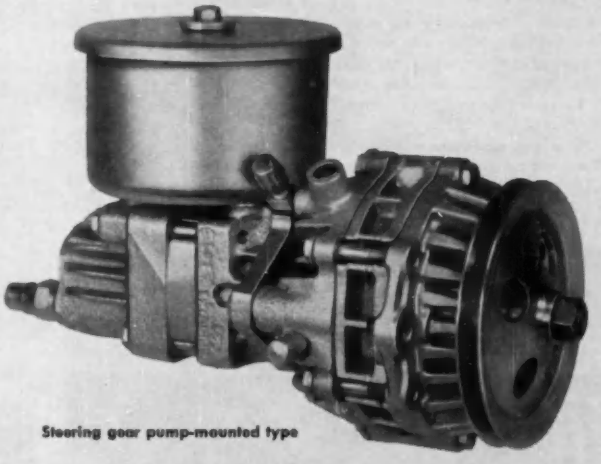


Accessory-mounted type



Steering gear pump-mounted type

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AC brings an entirely new idea to air-supply compressors for passenger car applications. AC engineers are the originators of high-pressure rotary compressors used for this purpose.

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GM GENERAL MOTORS

Watch WIDE WIDE WORLD . . . NBC-TV

AC SPARK PLUG THE ELECTRONICS DIVISION OF GENERAL MOTORS

## Synchro-Start SPEED SENSITIVE SWITCHES

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One, two, and three switch units employ the same basic governor flyweight principle which has been used successfully in SYNCHRO-START OVERSPEED GOVERNORS during the past fifteen years.

*Request Bulletin 504*

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Stops Losses making Dies and Templates

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*Write for sample on company letterhead*

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2301L North 11th St. • St. Louis 6, Mo.

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RAILS

*New* **RAILS** *Relaying*

**TRACKWORK of ALL KINDS**

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HEAVY RAILS—60# TO 100#—30'0" & 33'0"
JOINT BARS, BOLTS, TIE PLATES, SPIKES & TOOLS, FROGS, SWITCHES, STANDARD & SPECIAL TRACKWORK.

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**KASLE STEEL CORPORATION**

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The design of this Ball Joint locates the ball socket in the same unit as the cross drilled hole. This provides additional wall thickness. A specially designed Ball Stud with a short neck enables *more than 250 lbs. force* to be applied on this unit. Swivel construction is assembled with a grease resistant neoprene washer to cushion movement and maintain proper tension. A spring clip allows rapid adjustment over great length, eliminating threaded rods and conventional set screws. Nut, lockwasher and spring Clip are permanently assembled on the unit to prevent loss. "EC" Ball Joints are stocked items for rod sizes 1/4" and 5/16". Present usage includes automatic transmission, heating, ventilating and air conditioning control applications.

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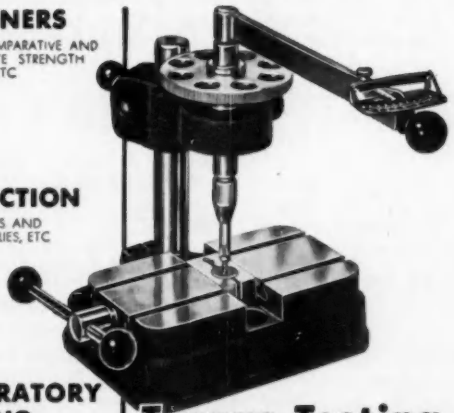

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*Write for Bulletin TF*

**P.A. STURTEVANT CO.**
ADDISON QUALITY ILLINOIS

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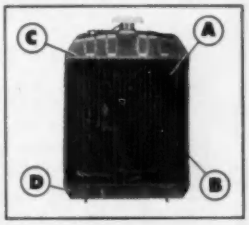
# Young Engineering Talent Pays off for SAFE-WAY*

*Safe-Way School Bus, built by Marmon-Herrington Co., Inc., Indianapolis, Ind.

## Young Side-Mounted Radiators keep 182-hp. bus engines cool

**The Problem:** To select an engine-cooling radiator built for easy accessibility and efficient upkeep.




Young Stamped Tank Radiator

## How Young solved it

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C. Double-grip 2-way headers.

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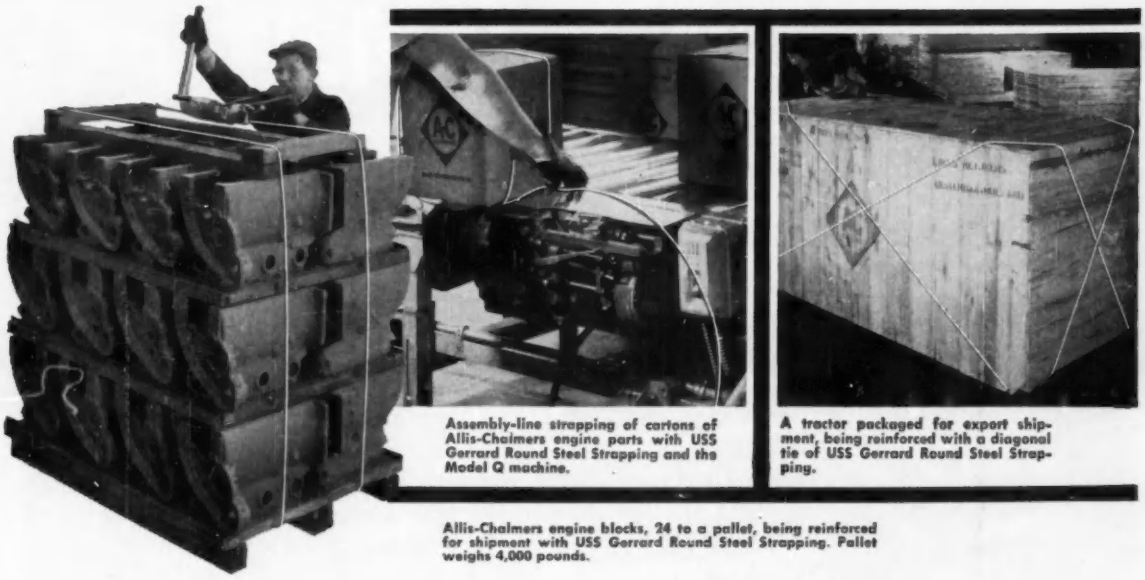
## ties anything you've ever seen



Assembly-line strapping of cartons of Allis-Chalmers engine parts with USS Gerrard Round Steel Strapping and the Model Q machine.

A tractor packaged for export shipment, being reinforced with a diagonal tie of USS Gerrard Round Steel Strapping.

Allis-Chalmers engine blocks, 24 to a pallet, being reinforced for shipment with USS Gerrard Round Steel Strapping. Pallet weighs 4,000 pounds.

## Allis-Chalmers Manufacturing Company, Tractor Works, West Allis, Wis., reinforces packages of all sizes quickly, securely, and inexpensively with USS GERRARD ROUND STEEL STRAPPING

When Allis-Chalmers West Allis, Wis., Tractor Works began packaging replacement parts in cartons to improve its shipping operation, USS Gerrard Round Steel Strapping was chosen as reinforcement. As a result, it provides a neat, inexpensive way to close cartons quickly, protects the product, saves the carton for re-use, and displays the advertising on the box continuously.

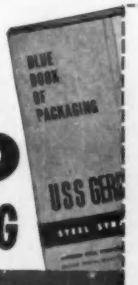
Allis-Chalmers is using USS Gerrard Round Steel Strapping to secure packages which vary from 4-inch-square boxes, weighing less than a pound, to huge 38" x 30" x 34½" cartons which weigh up to 3,000 pounds. Even complete tractors are disassembled and crated for export to reduce cubage charges. They, too, are reinforced with USS Gerrard Round Steel Strapping.

Take a tip from a highly successful organization, and try USS Gerrard Steel Strapping – Round or Flat. Whatever your packaging-tying problem might be, our engineers can help you find the safest, most economical solution. Contact us now.

GERRARD STEEL STRAPPING DIVISION, UNITED STATES STEEL CORPORATION
GENERAL OFFICES: CHICAGO, ILLINOIS

USS GERRARD STEEL STRAPPING
*Round and Flat*

UNITED STATES STEEL

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## The All-Temperature Piston

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**STEEL TENSION MEMBER**

Anchored only at pin bosses and cast in positive contact with I.D. of piston skirt

Controls Clearance Automatically

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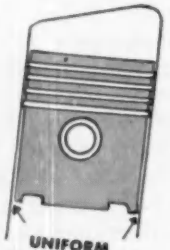

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